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ABSTRACT

These activity sheets, developed by personnel of the Agricultural Extension Service of the University of Minnesota, were designed for youth group campers but may be used by other populations and individuals. Each activity sheet focuses on a separate topic: (1) Selecting Suitable Uses for Land, (2) Measuring the Steepness of Land, (3) Determining Soil Texture, (4) The Great Rainfall Runoff Race, (5) Building a New Town, (6) Exploring the Prairie and Forest, (7) Exploring the Pond or Lakeshore, (8) Exploring the Soil, (9) Exploring Gray Squirrel Environments, (10) Studying Soil Erosion and Its Control, and (11) A Classroom Full of Trees. Each sheet is similar in format: descriptive information is provided relating to the topic of the activity and directions are given for preparing the materials needed for the activity. A brief teaching outline is provided for some of the activities. (PEB)

AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA
Environmental Education
Activity Sheet No. 1
Rev. Oct. 1972

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# Selecting Suitable Uses for Land (step 1)

Clifton F. Halsey

ED 094 148

Date _____

School _____

Name _____

Land Area No. _____

County _____

Everyone uses the land. All of us use products of the land for food, clothing, and shelter. We reshape it for homes, factories, roads, and recreation. Natural forces such as water, wind, gravity, and chemical and biological activity continually influence the land as we use it.

Land and soil vary in many ways—slope or steepness, soil texture, depth, flooding, internal drainage or wetness, fertility, etc. Each area of land is more suitable for some uses than for others. Frequently our uses are detrimental to ourselves, to other people, to the land we are using, and to other portions of the environment.

This activity will help you:

a. identify important features of the land and soil;

b. recognize variations in these features, resulting secondary characteristics and their inter-relationships, and common combinations of land features;

c. learn how features of the land influence its suitability for common uses; and

d. develop your ability to choose suitable uses for land and soil.

As you gain experience in this activity, you will be able to understand better (a) the inter-relationships between soil, plant growth, and associated animal populations; (b) the soil features that affect erodibility; and (c) effects of human and animal uses on the land.

You will be able also to use the land more wisely with minimum undesirable effects on the environment by erosion, sedimentation, nutrient pollution, etc.

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Clifton F. Halsey is extension conservationist—soils, and assistant professor, Department of Soil Science. The author acknowledges the cooperation of other members of the Department of Soil Science, the College of Forestry, and the U.S. Soil Conservation Service.

SE 016 025

| USE | SUITABILITY | FEATURES OF THE LAND | | | | |
|---|---|---|---|---|---|---|
| | | % SLOPE | SOIL TEXTURE (Surface soil only unless specified otherwise.) | FLOODING DURING GROWING SEASON or use (frequency-duration) | INTERNAL DRAINAGE | DEPTH TO RESTRICTIVE LAYER (inches) |
| Home lawns, shrubs and gardens | Good-no important limitations | 0–6 | medium | none | well drained, moderately well drained | more than 36 |
| | Fair-one or two important limitations | 6–12 | moderately fine, or moderately coarse | once a year, not over 3 days | somewhat poor, poor | 20 to 36 |
| | Poor-severe limitations | more than 12 | fine or coarse, organic | more frequent or more than 3 days | excessive | less than 20 |
| Cultivated crops | Good | 0–6 | medium, moderately coarse | none | well or moderately well drained | more than 36 |
| | Fair | 6–12 | moderately fine, fine, organic | once a year, less than 48 hours | somewhat poor (needs drainage) | 20 to 36 |
| | Poor | more than 12 | coarse | more frequent, longer | poor or excessive | less than 20 |
| Permanent grass pasture | Good | 0–18 | medium or moderately fine | up to 4 times annually, less than 48 hours | well or moderately well drained | more than 36 |
| | Fair | 18–25 | moderately coarse or fine | more than 48 hours | somewhat poor, poor | 20 to 36 |
| | Poor | more than 25 | coarse, organic | 5 times or more annually | excessive | less than 20 |
| Forests–conifers, for wood products | Good | 0–18 | (Entire Root Zone) medium, moderately coarse | never | well drained, moderately well drained | more than 20 |
| | Fair | 18–45 | moderately fine, coarse | never | somewhat poor, excessive | |
| | Poor | more than 45 | fine, organic | any flooding | poor | less than 20 |
| Forests–deciduous, for wood products | Good | 0–18 | (Entire Root Zone) medium, moderately fine | once in 10 years | well drained, moderately well drained | more than 20 |
| | Fair | 18–45 | moderately coarse | annual spring flooding | somewhat poor, excessive | |
| | Poor | more than 45 | coarse, fine, organic | more than once annually | poor | less than 20 |
| Forest–wildlife habitat | Good | 0–25 | (Entire Root Zone) moderately coarse thru moderately fine | once in 10 years, less than 24 hours | well or moderately well drained | more than 20 |
| | Fair | 25–50 | coarse or fine, organic | up to 4 times annually, 24 to 48 hours | somewhat poor, excessive | |
| | Poor | more than 50 | | more frequent, more than 48 hours | poor | less than 20 |
| Water fowl habitat | Good | Can have surface water continuously, open water all summer, and be more than 3 feet deep. | | | poor drainage | |
| | Fair | Can have surface water and open water during spring only, less than 3 feet deep. | | | somewhat poorly drained | |
| | Poor | Can have short periods of open water, less than 1 acre | | | moderately well to excessively drained | |
| A. Athletic, play and picnic grounds<br>B. Public campgrounds, primitive campsites | A. Good<br>B. Good | 0–2<br>0–6 | medium, moderately coarse | none during use | well and moderately well drained | more than 36 |
| | A. Fair<br>B. Fair | 2–6<br>6–12 | coarse, moderately fine | once-less than 24 hours | somewhat poor | 20 to 36 |
| | A. Poor<br>B. Poor | more than 6<br>more than 12 | fine, organic | 2-3 times during season | poor, excessive | less than 20 |

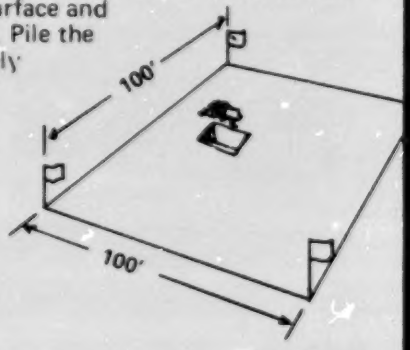
| AVAILABLE WATER FOR PLANTS (inches) Capacity to 5 ft. deep | ERODIBILITY | OTHER IMPORTANT FEATURES NOT EASILY IMPROVED |
|---|---|---|
| more than 9 | slight | |
| 6 to 9 | moderate | |
| less than 6 | severe | moderate to strongly alkaline, pH more than 8.0 |
| more than 9 | slight | |
| 6 to 9 | moderate | |
| less than 6 | severe | moderately to strongly alkaline pH more than 8.0 |
| more than 9 | slight | |
| 6 to 9 | moderate | |
| less than 6 | severe | moderately to strongly alkaline, pH more than 8.0 |
| more than 6 | | soil fertility: medium to high pH: 5 to 6 |
| 3 to 6 | | soil fertility: low |
| less than 3 | | |
| more than 9 | | soil fertility: medium to high pH: 6 to 8 |
| 6 to 9 | | soil fertility: low |
| less than 6 | | pH: less than 5, more than 8 |
| more than 9 | | |
| 6 to 9 | | |
| less than 6 | | pH: less than 5, more than 8 |
| | | |
| | | |
| | | |
| more than 9 | slight | |
| 6 to 9 | moderate | |
| less than 6 | severe | |

| USE | SUITABILITY | % SLOPE | SOIL TEXTURE (Surface soil only unless specified otherwise.) |
|---|---|---|---|
| Land exposed to erosion during construction or use | Good | 0–2 | coarse, moderately coarse |
| | Fair | 2–6 | medium to fine |
| | Poor | more than 6 | |
| Houses and other low buildings | Good | 0–6 | To 5 feet deep. coarse, moderately coarse |
| | Fair | 6–12 | medium, moderately fine |
| | Poor | more than 12 | fine, organic |
| Basements and utility excavations | Good | 0–6 | To 5 feet deep. medium, moderately coarse coarse |
| | Fair | 6–12 | moderately fine |
| | Poor | more than 12 | fine, organic |
| Home sewage absorption fields | Good | 0–6 | To 5 feet deep. medium, moderately coarse |
| | Fair | 6–12 | moderately fine |
| | Poor | more than 12 | coarse, fine, organic |
| Local streets | Good | 0–6 | To 5 feet deep. moderately coarse, coarse |
| | Fair | 6–12 | moderately fine, medium |
| | Poor | more than 12 | fine, organic |

## SITE SELECTION AND PREPARATION

1. Choose one or more areas, at least 100 x 100 feet in size if possible. The area should be uniform in slope, soil texture, and land form. Mark the boundary corners of each area plainly with flagged stakes.

2. Dig a pit about 3 feet x 3 feet in horizontal dimensions at the surface and about 3½ feet deep. Pile the surface soil separately where the students can feel its texture. Shovelful samples may be arranged in order behind



| FEATURES OF THE LAND | | | | | |
|---|---|---|---|---|---|
| FLOODING DURING GROWING SEASON or use (frequency-duration) | INTERNAL DRAINAGE | DEPTH TO RESTRICTIVE LAYER (inches) | AVAILABLE WATER FOR PLANTS (inches) Capacity to 5 ft. deep | ERODIBILITY | OTHER IMPORTANT FEATURES NOT EASILY IMPROVED |
| | well drained, excessive | | | none to slight | |
| | moderately well drained, somewhat poor | | | moderate | |
| | poor | | | severe | |
| none | excessive, well drained, moderately well drained | To bedrock, water more than 36 | | | |
| none | somewhat poor | 20 to 36 | | | |
| any | poor | less than 20 | | | |
| none | well drained, excessive | To bedrock, water more than 5 feet | | | |
| none | moderately well drained | 3½ to 5 feet | | | |
| any | somewhat poor, poor | less than 3½ feet | | | |
| none | well drained | 6 feet | | | |
| none | moderately well drained | 6 feet | | | |
| any | somewhat poor, poor, excessive | less than 6 feet | | | |
| none | excessive, well drained, moderately well drained | To bedrock, more than 36 | | | |
| once a year, not over 3 days | somewhat poor | 20 to 33 | | | |
| more frequent, more than 3 days | poor | less than 20 | | | |

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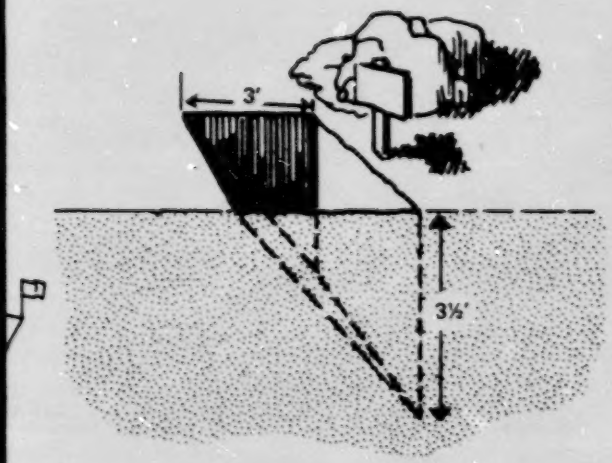



the pit and away from its edge. For best lighting, orient the pit so the sun shines on the side of the pit that is to be observed. A V-shaped pit with the side to be observed vertical is desirable.

3. Use a sign to label the area and provide needed information that is not visible to the participants. Information may be depth to restrictive layer, soil reaction, flood hazard, etc.

## PROCEDURE

a. This exercise can be more helpful and enjoyable if you understand clearly the meanings of the various terms used. Study the discussion and definitions of terms which follow these instructions before you begin the activity. Refer to them when necessary.

b. For each use of the area of land being studied, (1) circle the most likely description of each feature on the card, (2) consider the relative importance of each feature you have checked, (3) circle the degree of suitability (good-fair-poor) you select to indicate how appropriate the area is for the use you are considering.

The relative importance of a land feature may be somewhat difficult to decide. The hazard of floods is very important when the use involves life, health and property. Slope is very important when the use involves erodibility, sedimentation, and the actual feasibility of the use. Soil texture, internal drainage, depth of root zone, and available water capacity are important for plant growth. Descriptions of features are to be considered only where the descriptions are stated for the use. Certain features are of lesser importance when considering some land uses; in such cases the features are not described in the corresponding boxes.

## DISCUSSIONS AND DEFINITIONS OF TERMS

### Suitability

The terms—good, fair, and poor— refer to the suitability of the area for the use (in the left hand column) being considered.

The terms—good, fair, and poor—also apply individually to the quality of each feature as it is described on the same line to the right. For example, a slope of 0 to 6% may be considered good for home lawns; a slope of 6 to 12% is considered fair; more than 12% slope is poor for home lawns. This reasoning applies to each feature. If all the features for the area are described on the "good" line, the suitability of the area is good for that use. If all the features for the area are described on the "poor" line, the suitability of the area is poor for that use. However, if all the features for the area are described on the "fair" line, the suitability is not necessarily fair for that use; it may be poor.

Good: The area is physically well suited to the use being considered. None of the physical features described is a significant limitation. Existing limitations are easily reduced or corrected. The area is relatively free of hazards.

Fair: There are one or two important limitations that cause this area to be only fairly suitable for the use being considered. The limitations are considered moderate. It is economical to correct the limitations or reduce their influence.

Poor: The area is poorly suited for the use being considered. The limitations (there may be only one or two) are severe and very difficult or uneconomical to correct. In many cases the area should not be used in the way being considered.

### Slope

The steepness of slopes affects erodibility and usefulness; it is described in percentage ranges. A change in elevation of 1 foot per 100 feet of horizontal distance is expressed as a slope of 1 percent. Slope ranges are expressed as follows in Minnesota:

| | | |
|---|---|---|
| A | 0 to 2% | nearly level |
| B | 2 to 6% | gently sloping or gently undulating |
| C | 6 to 12% | sloping or rolling |
| D | 12 to 18% | moderately steep or hilly |
| E | 18 to 25% | steep |
| F | 25% and greater | very steep |

### Soil Texture

Soil texture indicates the sizes of the individual particles (sand-silt-clay) and the relative amounts of each size range in a soil. The textural classes are grouped below:

| Group | Class |
|---|---|
| fine | sandy clay, silty clay, clay |
| moderately fine | sandy clay loam, silty clay loam, clay loam |
| medium | silt, silt loam, loam |
| moderately coarse | sandy loam, fine sandy loam |
| coarse | sand, loamy sand |
| organic | peat, muck (mostly partially decomposed plant materials) |

To identify a soil's textural group, moisten a small amount of soil to the consistency of putty. Make a small ball of soil and squeeze it between your thumb and forefinger, pressing the thumb forward to form the sample into a ribbon.

Fine textured soils form a ribbon which is long and pliable. These soils feel smooth and sticky when wet due to their high clay content.

Moderately fine textured soils form a much shorter ribbon which breaks rather easily under its own weight. These soils are less sticky, but still feel very smooth when moist.

Medium textured (and coarser) soils will not form a ribbon. If the soil feels fairly smooth and flour-like, but slightly gritty, it is probably a loam or silt loam. Pure silt has no grittiness and feels quite smooth like flour.

Moderately coarse textured soils feel gritty and lack smoothness. Sandy loams have enough clay and silt to prevent them from falling apart readily after being formed into a ball.

Coarse textured soils feel very gritty and have very little smoothness or slickness.

Organic soils are judged by their appearance. Peat is less well decomposed and has a lower percentage of mineral matter than mineral soils.

### Flooding

We are concerned with flooding during the growing season, season of use, or whenever flooding could cause problems with the use being considered.

Plant species vary in their tolerance to flooding in terms of the season, the duration of the inundation, and frequency. Flooding also affects the suit-

ability of land for wildlife habitat and for various structural uses such as homes and streets.

### Internal Drainage

Internal drainage is the ease with which water and air may move through the soil. Internal drainage affects aeration, plant water, and runoff. Soil texture, depth to impervious material, and water table elevation influence internal drainage. The amount of oxygen present influences soil color. Oxidized iron compounds are reddish or yellowish; reduced compounds are gray. The color of the soil is a good indication of internal drainage. Use the table below to select the correct quality of internal drainage.

| Internal drainage | Description of subsoil color |
|---|---|
| excessive | Coarse textured, yellowish brown. |
| well drained | Uniformly brown, dark brown, yellowish brown, dark yellowish brown, or reddish brown throughout subsoil. |
| moderately well drained | Same as well drained except the lower subsoil may be gray or mottled. |
| somewhat poor | Mottled upper subsoil while the lower subsoil will be gray or mottled. |
| poor or very poor | Dull gray or olive color while some mottles may be present. |

### Depth to Restrictive Layer

The depth of the root zone or depth to which plant roots can penetrate influences the amount of nutrients, water, and soil air to which the plants have access. Plant species also vary in the soil conditions to which they are adapted. Possible root zone limitations are compacted soil layers, water table, bedrock, and excessively coarse soils—coarse sand and gravel. Taller plants must have sufficient root depth to resist strong winds also. Plants depend on the soil for anchorage.

Water tables, bedrock, and coarse layers affect the suitability of land for home sewage absorption fields. Depth to water table and bedrock affect suitability for houses, basements, and local streets.

### Available Water for Plants

The amount of water available in the soil for plant growth affects plant productiveness (a) for vegetative cover to control erosion and withstand heavy foot traffic, (b) for food production for humans and wildlife, (c) for timber growth, and (d) for the lushness of lawns, shrubs, and flower gardens. Plant species vary in root development and the depth from which they draw water. Corn roots commonly grow 5 feet deep; alfalfa roots under arid conditions may extend 20 feet. Bluegrass roots are largely in the top 1 or 2 feet of soil. The soil texture and root zone depth greatly influence the amount of water the soil can hold for plant use. Capacity is usually expressed as inches of water that can be held by 5 feet of soil. The texture of the soil from the surface to a depth of 5 feet may vary considerably. Hence surface texture alone is not always a good indication of the capacity of the soil to hold water for plants. (Soil structure is frequently important but is not considered in this activity.)

The following table tells the average amounts of water the textural groups can hold for plants.

| Textural group | Range in inches of water per foot of soil |
|---|---|
| fine | 1.2 to 2.0 |
| moderately fine | 1.8 to 2.6 |
| medium | 2.0 to 2.9 |
| moderately coarse | 1.3 to 1.8 |
| coarse | 0.3 to 1.4 |
| organic | 4.2 to 8.4 |

Available water-holding capacity for 5 feet of soil may be expressed as follows:

good: more than 9 inches
fair: 6 to 9 inches
poor: less than 6 inches

### Erodibility

Erodibility is the ease with which soil, when unprotected, may be detached and carried away by raindrops and running water. Steepness and length of slope, surface texture, organic matter content, internal drainage, and vegetative or other protective cover all influence erodibility. The degrees of erodibility have the following meanings:

slight: during average conditions of weather and use there is little chance of excessive erosion. Slopes are gentle; internal drainage is good.

moderate: medium or finer textured soils on slopes of 2-6 percent and longer than 300 feet could have moderate erosion problems. Shorter slopes may be as much as 12 percent and still have moderate erodibility.

severe: slopes exceeding 12 percent with soils having a moderately coarse to fine texture.

### Other Important Features Difficult to Improve

Soil reaction (pH): The soil reaction, acidity or alkalinity, has varying influences on plants, depending upon the tolerance of the species. Soil acidity may be decreased by adding ground limestone. Alkalinity in soil is not as readily corrected. Few useful species will thrive in strongly alkaline soils where the pH exceeds 8.0. The term pH is used to indicate the degree of acidity or alkalinity. A pH of 7 is neutral; below 7 the smaller the number, the more acid the soil. Above 7, the larger the number the more alkaline the soil.

Soil fertility: Soil fertility is readily corrected by adding commercial fertilizers. The practice is not economically feasible for most forest uses in Minnesota, however.

AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA
Environmental Education
Activity Sheet No. 2 (Revised 1974)

# MEASURING THE STEEPNESS OF LAND

Clifton Halsey, extension conservationist-soils and associate professor, Department of Soil Science

The slope of land is its steepness. Slope is one of the most important features of land because slope affects the erodibility of the soil and its suitability for many uses.

Slope can be expressed as a percentage. The percentage of slope equals the vertical change in elevation between two points divided by the horizontal distance between them and multiplied by 100. In other words, the percentage of slope is the change in elevation (expressed in feet) between two points 100 feet apart horizontally.

This table tells how slopes are defined in Minnesota:

| DESCRIPTION | PERCENT SLOPE |
|---|---|
| nearly level | 0-2 |
| gently sloping | 2-6 |
| sloping | 6-12 |
| moderately steep | 12-18 |
| steep | 18-25 |
| very steep | 25 and greater |

The slope ranges are illustrated below.

**How to Make a Slope Gauge**

To help determine erosion potential and the suitability of a piece of land for various uses, you can make and use a slope gauge:

1. Glue or tack the slope gauge sheet (page 2 of this activity sheet) to thin plywood, hardboard, or stiff cardboard of the same size (8½ x 11 inches). Make sure the top edges of the sheet and board are evenly matched.

2. Glue or tack this instruction sheet to the other side of the board.

3. On the slope gauge sheet, place a thumb tack or small screw eye in the center of the circle at the top of the page. (Instead, you may want to make a small hole through the board.)

4. Tie a fishing sinker or large washer to a strong 10-inch string. Tie the other end of the string to the tack or screw eye attached to the board. (If you drilled a hole through the board, put the string through the hole and tie the string into a large knot to prevent the string from slipping out.)

**How to Use the Slope Gauge**

1. Working with another person or using a stick, determine the point on that person or stick that is the same distance from the ground as are your eyes.

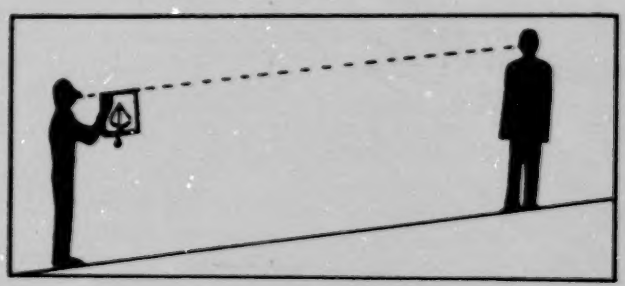
2. Place that person or stick either at the top or bottom of the slope you want to measure.

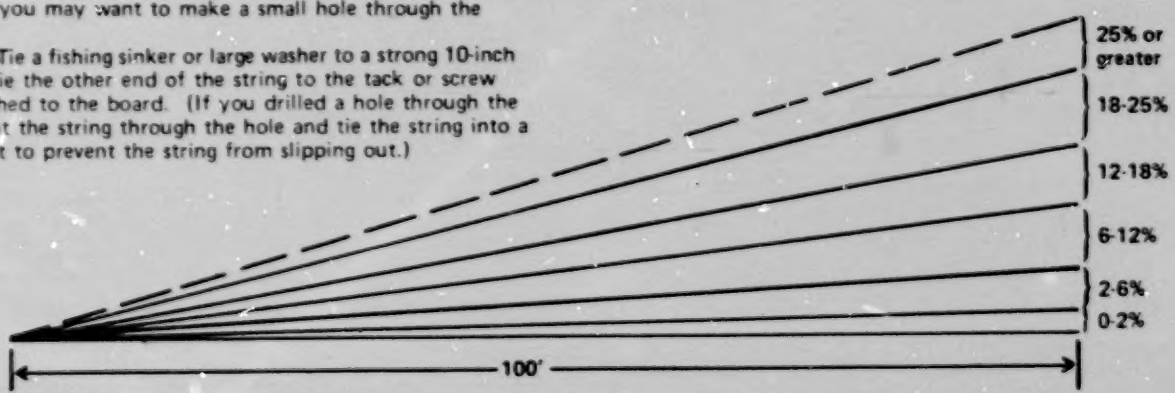
3. Go to the opposite point of the slope, i.e. if you placed the person or stick at the top of the slope, you should go to the bottom of the slope.

4. Aim across the top of the board to the point on the person or stick that is the same distance from the ground as are your eyes. Make sure the board is held vertically so the string can swing easily.

5. Hold the string at the point where it comes to rest on the scale. Read the percentage of slope where the string has come to rest.

The number where the string rests on the scale indicates the percentage of slope (the number of feet of change in elevation in 100 feet of horizontal distance).






**This figure illustrates the change in elevation in 100 feet of horizontal distance for each slope range.**

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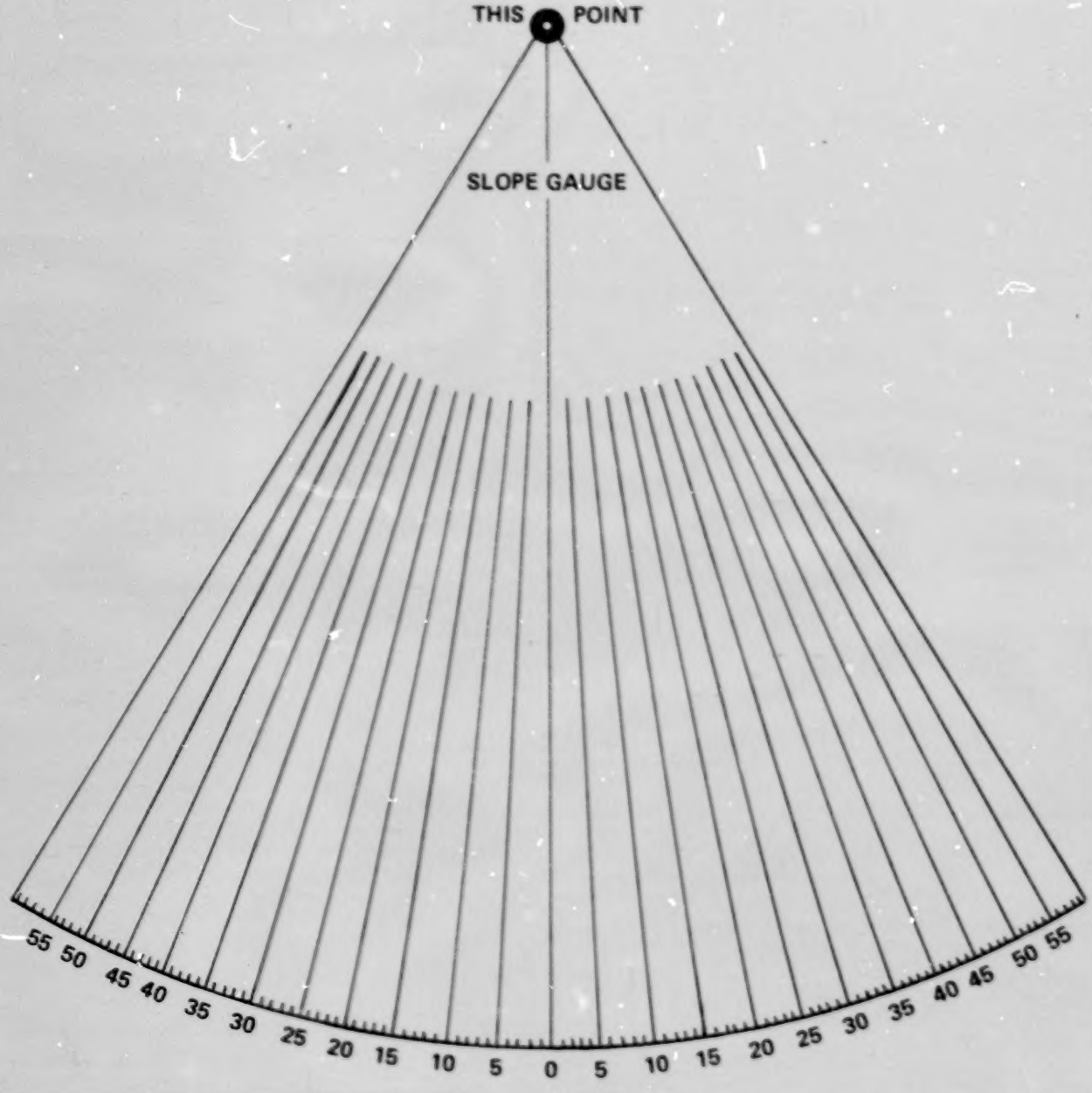
AIM ACROSS THE TOP OF THE BOARD

HANG WEIGHT ON A STRING FROM THIS POINT




**SLOPE GAUGE**

| Description | Percent Slope |
|---|---|
| nearly level | 0-2 |
| gently sloping | 2-6 |
| sloping | 6-12 |
| moderately steep | 12-18 |
| steep | 18-25 |
| very steep | 25 and greater |

**READ PERCENT SLOPE ON THIS SCALE WHERE STRING INTERSECTS**

At the point where the string rests on the scale, the number indicates the percent of slope, or the number of feet of change in elevation in 100 feet of horizontal distance.

AGRICULTURAL EXTENSION SERVICE

UNIVERSITY OF MINNESOTA

Environmental Education

Activity Sheet No. 3 (Revised 1974)

# DETERMINING SOIL TEXTURE

Clifton Halsey, extension conservationist-soils and associate professor, Department of Soil Science

A soil's texture is its proportions of sand, silt, and clay. Texture is one of the most important features of soil.

Sand is coarse soil particles. Most sand particles can be seen without magnification. Sand particles feel rough when you rub them between your thumb and fingers.

Clay is the smallest of soil particles. Individual clay particles can only be seen through the strongest microscopes. When clay particles are separated and dry, they feel smooth and powdery. Dried chunks of clay are very hard and are difficult to break. Wet clay is slick and sticky; it holds the form into which it is molded.

Silt particles are larger than clay, but smaller than sand. A microscope is required to see individual silt particles. Dry silt particles feel smooth and floury. Wet silt feels smooth, but not slick and sticky.

Some of the reasons a soil's texture is important are because texture influences:

- how readily the soil erodes;
- how much water, air, and plant nutrients the soil can hold;
- how easily water percolates through the soil.

Although the proportions differ, most soils have at least some amounts of all three——sand, silt, and clay. Scientists divide soils into several textural classes based on a soil's proportions of sand, silt, and clay. These may be grouped as follows:

| GROUP | CLASS |
|---|---|
| fine | clay, silty clay, sandy clay |
| moderately fine | clay loam, silty clay loam, sandy clay loam |
| medium | silt, silt loam, loam |
| moderately coarse | fine sandy loam, sandy loam |
| coarse | loamy sand, sand |
| organic | organic |

You can determine a soil's textural group by feeling it. First, moisten a marble-sized portion of the soil and knead it in your hand until the soil has the consistency of putty. Then, squeeze the ball of soil between your thumb and forefinger, pressing your thumb forward to push the soil into a ribbon. Whether a ribbon forms and the type of ribbon that forms indicate the type of soil it is.

WILL FORM A RIBBON

Fine-textured soil (see photo below) forms a long, shiny, pliable ribbon. The moist ribbon feels smooth and sticky. Dry clods are very hard.

Moderately fine-textured soil forms a short, slightly shiny ribbon. This ribbon breaks easily because of its weight. It also feels less sticky than fine-textured soil . However, the moist soil is still very smooth. Dry clods are hard.

WILL NOT FORM A RIBBON

Medium-textured soils (see photo below) and those coarser do not form ribbons. Medium-textured soil feels fairly smooth and floury. Silt is not gritty, but loam and silty loam are slightly so. Dry lumps of medium-textured soils are readily broken.

Coarse-textured soil (see photo below) feels very gritty. It is not slick or smooth, and formed casts of such soils fall apart when touched.

Organic soils (see photo below) are primarily decayed plant material. Such soils feel very light when they are dry. Well-decayed muck and peat are powdery, while partially decayed peat is fibrous.

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AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA
Environmental Education
Activity Sheet No. 4

# THE GREAT RAINFALL RUNOFF RACE

Clifton Halsey, extension conservationist-soils and assistant professor, Department of Soil Science

Soil erosion by wind and water is a natural occurrence in the environment. Mountains wear down to plains. Wind and water formed the Grand Canyon, the Badlands, and the Mississippi River delta. If there were no erosion, there would be very little soil.

Many of the things that man does speed up or accelerate erosion. Valuable topsoil is lost from fields, prairies, and forests. As we build homes, shopping centers and highways we frequently expose the soil to serious erosion. The resulting sediment muddies our lakes and streams and causes many undesirable changes.

This activity demonstrates how soil erodes and affects our environment. It illustrates some ways to control erosion.

**Objective**

The participant should be able to describe how water erodes soil and how we can control erosion. Your group should be able to suggest several undesirable effects of uncontrolled erosion.

**Specifications**

Age group: 10 years and older
Activity time: ½ hour
Group size: about 20
Group leader: a senior high school or college student, a teacher or adult leader

**Preparation Time**

30 to 40 minutes

**Equipment**

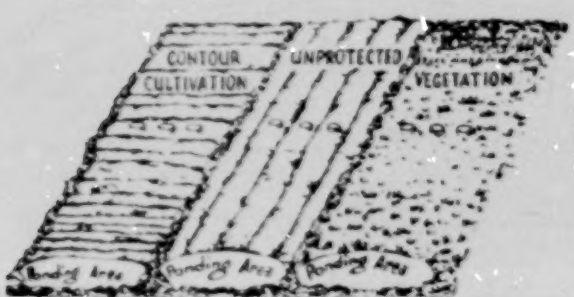
a. 3 identical 1- to 2-gallon sprinkling cans (may be made from coffee cans or plastic pails by punching 10 to 15 nail holes in their bottoms).

b. 2 to 3 gallons of water per race (in pails or other containers or from a lake or stream).

c. 3 sheets of plastic about 18 inches wide and 2 to 3 feet long.

d. garden hoe or trowel.

e. 3–2- or 3-pound coffee cans.




f. 3 simple 6-inch rulers (make simple ones from tongue depressors or popsicle sticks).

g. 6 or 9 pebbles or small metal or plastic discs.

h. 4 to 6 square feet of closely clipped sod (or use grass or straw mulch instead).

**Outdoor Preparation**

Find an even slope on a loam soil on a hillside. (Sandy soils soak up too much water.) At the bottom of the slope, prepare three adjacent square or rectangular "fields" measuring 2 to 3 feet on each side. Separate them with a ridge of soil. Scoop out small ponding areas on the lower side of each "field" and line the ponds with plastic sheets to collect runoff and sediment from each field. (Cover the upper edges of the liners with a firmly packed layer of soil.)

Use the center field as the unprotected field. Smooth out the soil. You may want to compact it somewhat and make miniature paths, tracks, or furrows down the slope.

Prepare one adjacent field to illustrate tillage practices. Using a garden hoe or trowel, make contour furrows 1 to 2 inches deep and about 4 inches apart across the slope. Be sure you don't divert water to the unprotected field.

Establish the vegetated field on the other side with the closely clipped sod. If you use grass or straw mulch work it lightly into the soil.

Sprinkle water over all three fields until they are thoroughly wet.

Place 2 or 3 pebbles or small discs on the upper part of each field to later illustrate the depth of soil eroded.

Prop short, simple rulers in the ponding areas to later measure the depth of sedimentation. You can use a couple of small rocks to prop the rulers up.

**Teaching Outline**

Intoduction (1 minute) – We are going to run the Great Rainfall Runoff Race. Here are 3 "fields" that we are going to use. You will pick the winner. Then we'll figure out why one field won.

Meeting the Contestants (the 3 fields) (3 minutes) Explain the three fields–unprotected, contoured, vegetated. Ask the group to name places they've seen (or can see from where they are standing) that look like the fields. (Housing developments, farm fields, pastures, hayland, parks, paths, campgrounds, schoolyards, etc.)

The Runoff Race (10 minutes) – Pick 3 members of the group to be the "rainmakers". Give them each a sprinkler and a can with about 1 gallon of water. Be sure that each rainmaker has the same amount. Tell

them how the race will be run. Each rainmaker must sprinkle the water over his field as evenly as possible when the starting signal is given. (Pour water into sprinkling can to start the race.) Three other young people can fill the sprinklers for the rainmakers. Ask the group to place their bets. Count the number who think each field will win.

Pick three judges. Instruct them to pick the field on which the water reaches the pond last, the one with the least water in the pond, and the one with the cleanest water in the pond. Then determine the champion.

Begin the race and allow enough time for most of the runoff from the unprotected field to come down.

The Results (4 minutes) –

(a) Ask the group to give reasons why certain fields won. Why did one have slower runoff than another? Why was one muddier than another? What happened to the water that didn't run off? Ask other questions and start discussion to teach principles of erosion control.

(b) Ask the young people to name specific places they have seen that look like the ponding areas. (Polluted lakes, muddy rivers, ponds near construction areas, river plains, etc.)

(c) What harm do erosion and sedimentation do? (Ask the group) Good soil is important for economical food. Good topsoil serves as a blanket to protect underlying more erodible soil. Erosion reduces the usefulness of land and is costly to repair. Sediment ruins the land below, fills river beds to reduce navigability and raises flood levels, fills reservoirs reducing the flood water holding capacity, ruins lakes for fish by raising the bottom and reducing sunlight in the water. Nutrients in runoff increase algae growth in lakes.

Future Races (Application) (3 minutes) – Ask the group, "If you were in the runoff race as a farmer, a road contractor, housing development contractor, a cattle or sheep rancher, a logger, etc., what would you do to win the race?" (Control soil erosion)

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**Basic Concepts** (Not to be read to the group)

General – The universe, including the earth and all its living and nonliving parts, is constantly changing.

Land – The earth's surface is constantly changing.

The formation of soil is a slow and continous process, taking 100 years or more to form one inch of soil.

The decay of plant and animal remains normally builds soil from the top downward.

Soil erosion is a natural geologic process of relocation by gravity, wind, and water.

The length of the slope as well as its steepness affect the rate of runoff and soil erosion.

Living Things – Grasses are one of the best natural means for controlling erosion because of their root and stem structure, their resistance to adverse conditions, and their relatively dense growth.

Water is a transporter of living and nonliving things.

Living things are normally adapted by structure and function to living in a particular environment, habitat, or set of conditions. As the characteristics of the environment change, the characteristics of the plant and animal species inhabiting the area may change or the species may change.

Some plants and animals tolerate a wide range of environmental conditions and may thrive as a result of change. Others can tolerate very little change and may disappear from the community.

Plants are directly or indirectly the source of all food energy for animals.

Plants inhibit soil erosion.

Man – Man manipulates components of the environment to better satisfy his desires for shelter, food, pleasure, etc. He also partially adapts himself to the environment.

A resource is something man uses to satisfy his wants.

Man manipulates the environment in many ways that are considered undesirable.

Because man frequently is unable to foresee the results of his actions or does not care about their effect on others or because private interests and public interest frequently conflict, resources are often not used for the greatest good for the greatest number of people.

Proper resource management should be the responsibility of everyone who uses natural resources.

Land and Man – Land is useful to man in many ways.

Land varies in its suitability for man's many uses.

Soil is a basic resource that man can improve or impair.

Productive soil is the chief resource upon which the agricultural industry depends.

Man alters the natural characteristics of the soil through farming practices such as plowing, fertilizing, and changing the vegetation.

Soil deterioration has the same effect on crop production as reducing the amount of land available for cultivation.

Man's use of the land can harmfully accelerate erosion and cause fertile, sloping soils to erode relatively quickly.

Erosion may accelerate on sloping bare cropland, over-grazed grassland, and pastured and burned woodland.

Muddy water running off a field is a sign of erosion.

Compaction caused by poor tillage practices and/or heavy packing reduces the soil's pore space and its ability to hold and percolate water.

The deposition of silt and coarser materials carried from eroded watersheds necessitates costly repeated dredging of navigable stream channels and harbors, destroys the habitat of fish, shortens the useful life of reservoirs, and greatly reduces the recreational utility of streams and lakes.

Runoff and soil erosion can be reduced by good land-use practices, which vary with land characteristics, climate, and topography.

Plant nutrients, such as nitrogen and phosphorus, are transported from the land to lakes and streams by runoff. This enrichment or eutrophication may enhance fish production but the resulting increased algae growth is aesthetically undesirable.

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AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA

Environmental Education
Activity Sheet No. 5

# BUILDING A NEW TOWN

Clifton Halsey, extension conservationist-soils and assistant professor, Department of Soil Science

The people in very few communities plan their towns before they build them. Most towns consist of plats and additions that grow helter-skelter creating disharmony among the various types of landowners and users. Some developers have only themselves and a single purpose in mind. This activity demonstrates how towns usually grow. It also provides an opportunity for the participants to plan the town before they build it.

### Objective

The participant should be able to describe some of the problems and conflicts that may develop when people in a community give little or no consideration to others as they use land and space to suit their own desires. He should be able to demonstrate some adjustments in land use that would be beneficial to the community.

### Specifications

Age group: 10 years and older
Activity time: ½ to 1 hour
Group size: 20 to 30 people
Group leader: A senior high school or college student, a teacher or adult leader

### Equipment

A. Large cards representing uses (minimum size 9" X 12" poster board)

| Number of cards | Use |
|---|---|
| 3 | homes |
| 3 | golf course |
| 3 | hunting |
| 2 | park |
| 2 | cropland |
| 1 | cattle feedlot |
| 1 | city dump |
| 1 | junkyard |
| 1 | factory |
| 1 | shopping center |
| 1 | fishing |
| 1 | swimming beach |
| 1 | water skiing |
| 1 | sewage discharge |
| 1 | school |
| 23 cards required | |

B. Prepare 20 or more large cards on 4 foot stakes to represent an assumed original terrain, soil, vegetation, and wildlife. See sample townsite for examples.

### Preparing the Children for the Activity

Things to consider when planning land uses in a community.

Many factors should be considered when people plan and build a new community or add to an existing one. When a place is chosen for a specific use such as a factory, feedlot, or freeway and it is built, a set of environmental relationships is created that is almost permanent. Conversely, a group of homes built near an existing factory, feedlot, or freeway creates a new set of relationships. These may be desirable or undesirable. There may be odors, traffic congestion, air pollution, noise, or a decrease in property values. The industry may find itself besieged by court injunctions, lawsuits, additional government regulations, costly controls, etc. There are many examples of such conflicting uses.

Considerate (for all who may be affected) land use planning can result in a more harmonious community and better places to "live, work, and play." Children can be taught some of the principles of land use (environmental) planning in elementary school. They can build on these principles in high school social studies. Then, as they assume adult roles in the community as members of governing bodies, advisory commissions, and concerned citizens, they can be more effective in developing communities that are desirable to live in.

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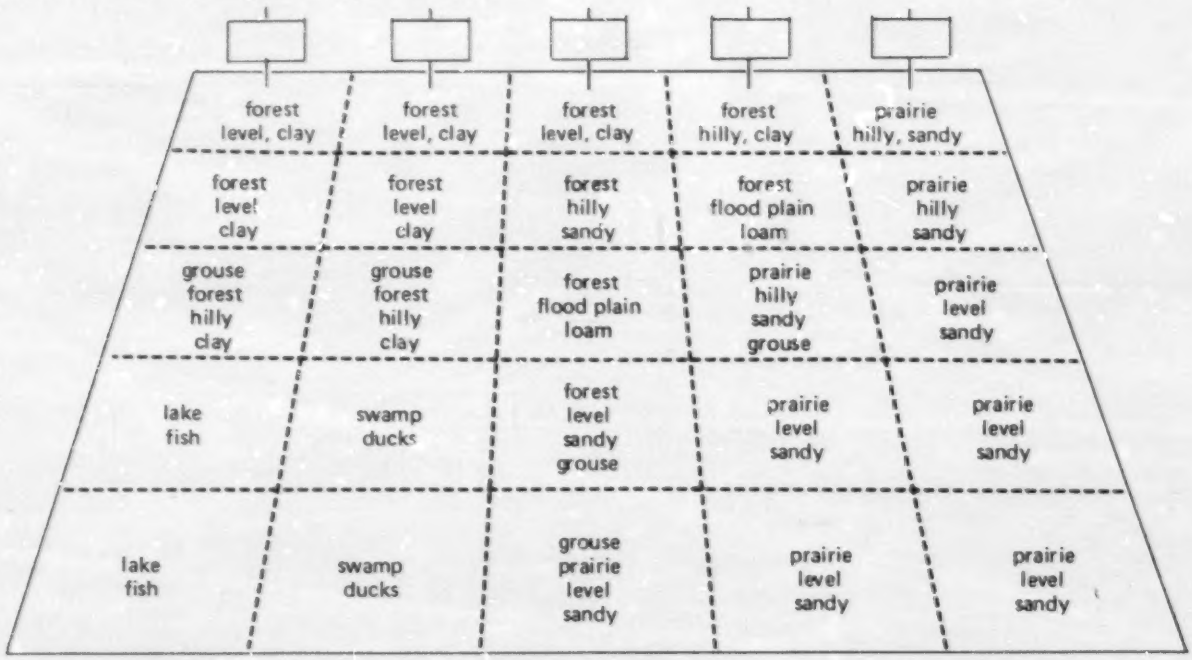
Sample townsite marked off in checkerboard fashion. Note placement of cards to represent different uses in top row.




Preparation for a community-planning activity can include these considerations:

1. Give examples of what we need and use land and space for:

   places and ways to make a living and earn money—jobs, employment;
   places to live—homes;
   places to learn about life—schools;
   places to buy food and other things for living—stores, shopping centers;
   places for recreation, exercise, and enjoyment—parks, golf courses, swimming, fishing, hunting, boating, theaters, etc.;
   locations and methods for transportation—highways, airports, etc.;
   locations and methods for recycling and disposing of wastes;
   places to grow food and wood—farming and forestry;
   places for mining;
   etc.

2. Which uses of land and space may conflict (not go well together) when they are near each other? How do they conflict?

   Examples:
   farming and wildlife
   farming and forestry
   homes and airports
   homes and highways
   homes and feedlots
   homes and meat-packing factories
   homes and junkyards
   swimming and boating
   fishing and waterskiing
   swimming and sewage disposal
   etc.

3. Name some land uses that may be compatible (go well together):

   feedlots and farming
   feedlots and meat packing
   homes and farming (perhaps)
   homes and shopping centers (perhaps)
   homes and parks (maybe)
   swimming and fishing
   timber production and wildlife
   airports and farming
   etc.

When planning how land and space are to be used, we should consider the resources of the area and how we may use and change them.

Some considerations:

1. What are the scenic qualities of the area? Should we improve or preserve them or disregard what may happen to them?
2. What about the vegetation—the forest, marshes, and prairies? Is it of value to the community? Should we improve, preserve, or disregard it?
3. Should we preserve the wildlife and its habitat?
4. What are the qualities of the soil? What is it suitable and unsuitable for?
5. Etc.

The suitability of the soil for various uses should be a priority (first) consideration in environmental planning for community living. What are some of the characteristics that affect the soil's suitability for certain uses?

How important are the soil characteristics in column A as they affect the suitability of the soil for each of the possible uses in column B? Discuss.

| A. Soil Characteristics | B. Land Use |
|---|---|
| slope or steepness | farm crops |
| soil texture | home lawns, shrubs, and gardens |
| flooding | permanent pasture |
| seasonal wetness of soil | forests for wood products |
| depth of soil above rock | wildlife habitat |
| water-holding ability for plants | play, picnic, and camp grounds |
| erodibility | houses and basements |
| | streets |
| | waste recycling and disposal |

The activity, "Building A New Town," can be useful in determining and reinforcing the comprehension of the students about community land use planning.

**Outdoor Preparation**

Using the stakes and signs, label 20 or more blocks in checkerboard fashion. Set the stakes about four feet apart to make the entire town about 16 feet by 20 feet. Select the site for the town on a slope so the class can observe it from a somewhat lower elevation, if possible.

Select the initial terrain, soil, and vegetation for the townsite beforehand. Use some of the surrounding observable landscape as a pattern and for class reference later if practical. Make additional cards if you wish but remember KISS (Keep It Simple, Sir or Sis). Include a lake. (See example at top of facing page.)

**Teaching Outline**

Introduction

You are a group of pioneers who have come to settle a new community. You have traveled in pickup campers, travel trailers, and motorcycles. This is the area you've chosen for your new town.

First, we'll see what our townsite consists of. Then we'll decide how we want to use it. Finally we'll see how we can improve our new community.

Creating Townsite (5 minutes)

Briefly describe each labeled area, including the topography, soil, vegetation, and wildlife. Explain that these are the original natural resources on the townsite. Relate to the surrounding observable landscape if possible so the settlers get a good idea of the actual situation.

Developing the townsite (10 to 20 minutes)

Ask individual people to "develop" the town. Give them "use" cards and have them (1) pick out an area they think is best for that use, (2) stand in that area and hold the card so the rest of the townspeople can see it. Select uses in the following order:

- cropland (2 sections)
- factory
- sewage
- homes (2 or 3 sections) (sewage outlet and dump must be used)
- school
- city dump

the following are optional, let the settlers decide:

- golf course (must be used in 3 adjoining sections in a row or L-shaped)
- park (with baseball diamonds, tennis courts, picnic area, etc.—must occupy 2 adjoining sections)
- hunting (waterfowl, upland game in forest, and prairie)
- fishing
- swimming beach
- water skiing
- shopping center

Note: When "uses" are selected by settlers, have them decide whether or not trees will be cut, or the environment changed so that fish and game will decrease or become extinct.

Consider what we've done (3-5 minutes)

Get the settlers involved in discussing among themselves how their choices affect neighboring sections. Consider odors, pollution, erosion, aesthetics, etc.

Let's start over (5-20 minutes)

Ask the settlers to form a circle holding their cards so all can see them. Then using the cards in the same order as before, have the settlers decide where the various uses should be located. (Majority rules.) Again have each one go to the designated area. Permit them to shift around to make adjustments as planning progresses.

Continue until time is used or they lose interest.

Summary (5 minutes)

What do we need to know when we plan a community?

1. many things about the land we want to use,
2. the kind of a community we want to live in,
3. how to make what we want fit with what we have,
4. how everything affects other things.

**Basic Concepts** (not to be read to settlers)

Characteristics and components of the land, water, air, and sunlight vary in many ways and combine to form numerous different environments or habitats for living things.

Air, water, and/or land (soil) provide homes for all living things.

There are many types of soil with varying characteristics.

Living things are interdependent with one another and with other portions of their environment.

The interrelationships between the plant and animal members of an ecosystem and their environment determine the characteristics of a particular ecosystem.

Living things are normally adapted by structure and function to living in a particular environment, habitat, or set of conditions. As the characteristics of the environment change, the characteristics of the plant and animals species inhabiting the area may change or the species may change.

As the living and nonliving things common to an area or community influence one another, they reach a relatively stable relationship with one another called "the balance of nature."

When one kind of plant or animal is destroyed or reduced in numbers or becomes too numerous for the environment to support, other plants or animals are affected.

Some plants and animals tolerate a wide range of environmental conditions and may thrive as a result of change. Others can tolerate very little change and may disappear from the community.

Every community, no matter how large, has a definite limit in its capacity to provide food, water, and living space to animals.

Man manipulates components of the environment (manages resources) to better satisfy his desires for shelter, food, pleasure, etc. He also partially adapts himself to the environment.

Man, like animals and plants, uses the environment to dispose of his wastes.

Man's disposal of wastes causes changes in the environment that affect him and other living things. Disposing of wastes in a way that causes undesirable changes in the environment is called pollution.

Often resources are not used for the greatest good for the greatest number of people because of conflicts among public and private interests, and the inability of individuals to adequately foresee the results of their actions or care about effects on others.

AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA
Environmental Education
Activity Sheet No. 6

# EXPLORING THE PRAIRIE AND FOREST

Clifton Halsey, extension conservationist - soils and assistant professor, Department of Soil Science

Few of us are aware of the variety of signs of life at our feet when we walk through the tall prairie grasses or hike in the woods. We can discover entirely new and fascinating worlds of life in the grasses, flowers, shrubs and trees; on and in the ground; under the leaves; and under and in decaying wood. Understanding these worlds of life is a key to understanding the complex webs of interconnections and interrelationships on earth.

In this intriguing activity, participants themselves discover and interrelate the various forms of life they find.

### Objective

Each person should be able to describe a simplified food web involving the living things and signs of life discovered in a wild prairie, shrub or forest setting.

### Basic Concepts

Living things are interdependent, one with one another, and with nonliving parts of their environment. Living things interchange matter and energy in cycles or food webs.

### Specifications

Age group: 9 years and older.
Activity time: about 1 hour.
Group size: 10 to 30 people divided into exploring parties, 3 per party.
Group leader (chief explorer): 1 senior high school or college student, teacher or adult leader, for each 10 to 15 children.
Site: an uncropped grassland or natural prairie, brushy or forested area about 1 acre in size.

### Equipment

A. for each exploring party of 3 people
   1. a surveyor's line--a piece of string about 1 foot long,
   2. sample container--1 plastic bread bag, ice cream pail, coffee can or similar container,
   3. diary--2 sheets of paper, a writing board and a pencil,
   4. garden trowel or other small tool for digging,
   5. optional: a plastic hand magnifying lens from the variety store.

B. for the group leader or chief explorer
   1. 2 large sheets of paper on a hard cardboard or other backing, about 2 x 2 feet,
   2. black wax crayon or felt tip pen,
   3. 4 long stakes to mark the corners of the territory,
   4. roll of transparent adhesive tape.

### Site Preparation

Before exploring begins, clearly mark the 4 corners of the territory.

### Teaching Outline

Introduction and briefing (10 minutes)
1. Assemble the explorers at the base camp, a reasonably level cleared area.
2. Explain that they will need to imagine they are as small as gophers or chipmunks to explore the terri-

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tory. They will need to get close to the ground to see what animals see. They should also observe life in the sky and the trees, but not at such close range.
3. Divide the group into the exploring parties.
4. Have the parties choose their surveyor, biologist, and recorder.
5. Distribute the exploring equipment--one set to each party.

**Preliminary Exploration (20 minutes)**

Ask the exploring parties to reconnoiter (look over the whole territory), mapping the approximate locations of larger objects (the size of a mouse or bigger) on a sheet of paper. They can note animals (mice, birds, snakes, etc.) and their signs (homes, tracks, droppings, etc.), holes, boulders, shrubs, significant patches of plants, and the like.

Assemble the exploring parties at the base camp after about 10 minutes. Ask each party's recorder to tell what they found and where. Make a composite map of the territory as they report. Show the approximate location of each object reported.

**Mini-survey and Census (census-10 minutes, report-10 minutes)**

Explain to the explorers that each party will be going out into the territory to conduct a detailed survey of a small area. At their sites,

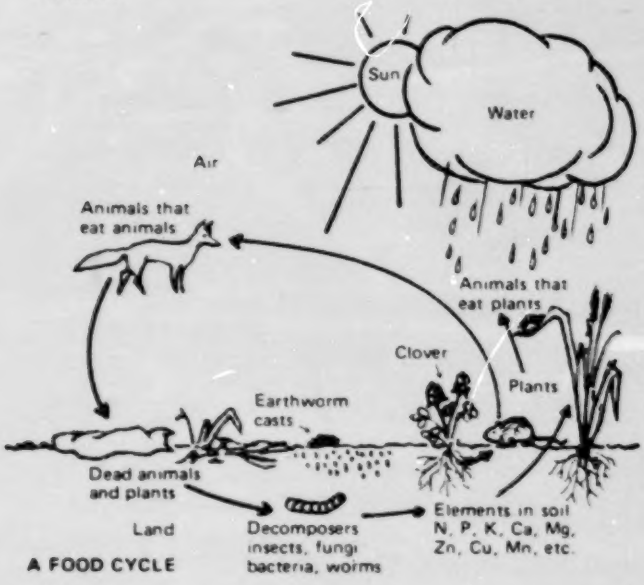
1. The surveyor should use the string to determine the boundaries of the party's area, holding one end of the string at one spot on the ground as the center of an imaginary sphere including the space above the ground, the ground itself, and 1 foot depth into the soil.
2. The biologist will pick up one sample of each thing found in the sphere and put it in the sample container.
3. The recorder will record what was found in the mini-area, noting each different object and how many of each were identified. If the party is unable to identify the items using specific names, they may use terms such as bug, grass, dead leaf, snail shell, etc. The explorers should also note homes and signs of very small animals--earthworm tunnels and castings, ant hills, cocoons, etc.
4. Spread the parties out in the territory so that they are as far apart as possible.
5. When it appears that the explorers have found all they are going to, call them back to the base camp for their reports.
6. Ask each party to report what and how many they found. Use the tape to fasten one sample of each item to the second large sheet of paper. Write the name of the object on the sheet if taping is difficult. Items may be arranged on the sheet as if it were a map of the area.

**Tying It All Together—The Food Web (10 minutes)**

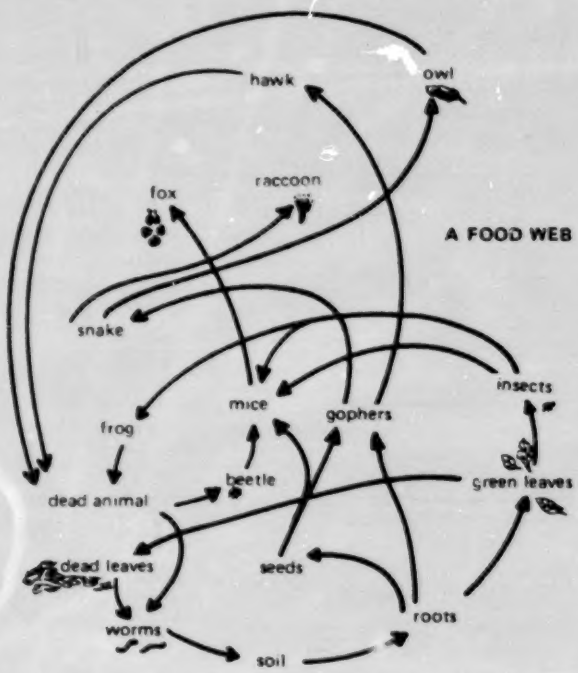
Briefly explain the food web to the explorers. Now have them connect the names and items together with lines and arrows (using the marker) in logical order that represents the food web (don't get complicated unless they think of cross-connections). Explain how every living thing is somehow connected to many other living and nonliving things. A change in one affects many others.

**Background Information for the Chief Explorer**

THE PARADE OF PLANTS, II. Upland Fields, III. Forests. Wisconsin Conservation Department. A food web (drawing).



A FOOD CYCLE



A FOOD WEB

AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA
Environmental Education
Activity Sheet No. 7

# EXPLORING THE POND OR LAKESHORE

Clifton Halsey, extension conservationist-soils and assistant professor, Department of Soil Science

Take off your shoes and join us as we wade into the relatively unknown world of life in the pond and along the lakeshore. You'll be amazed at the numbers and varieties of creepy crawlies darting about or floating in the water, clinging to the vegetation, hiding on the rocks, and buried in the bottom. Here is a mini-world that illustrates all levels of the food web.

### Objective

Each person should be able to describe simplified food webs and pyramids involving the living things discovered in the water and on the shore of a lake or pond.

### Basic Concepts

Living things are interdependent, one with another, and with nonliving parts of their environment. Living things interchange matter and energy in cycles or food webs.

### Specifications

Age group: 9- to 14-year-old children.
Activity time: about 1 hour.
Group size: 10 to 30 children working in exploring parties, 3 persons in each party.
Group leader (chief explorer): 1 senior high school or college student, adult leader or teacher for each 10 to 15 children.
Site: 100 to 200 feet of lake or pond shoreline having land-and water-side slopes where children can walk and wade safely. There should be vegetation in the water, along the shore. Swimming beaches are biological deserts—no good for this activity.

### Equipment

A. For each exploring party of 3 children:
   1. a sheet of paper, hard writing surface, and pencil,
   2. 2 plastic sandwich bags or their equivalent,
   3. a plastic bread bag or similar container,
   4. a plastic ice cream pail or coffee can,
   5. a large kitchen strainer or 6-inch square window screen,
   6. a glass jar,
   7. a shallow white dish or bottom of a bleach bottle,
   8. optional: hand magnifying lens purchased at a variety store.

B. For the group leader or chief explorer:
   1. 1 pair of 3 to 4 foot stakes or some flags to mark each exploring sector,
   2. 2 large sheets of paper mounted on cardboard or other hard board or backing, about 2 x 2 feet,
   3. 1 black wax crayon or marking pen.

### Site Preparation

Choose an area of lakeshore as previously described. Be sure it is free of poisonous plants and underwater hazards such as drop-offs, soft bottom, broken glass, and rusty nails. Along the shoreline at intervals of 10 to 20 feet, drive pairs of stakes the children may use as reference points. The stakes should be about 15 feet apart, one at the water's edge and the other 15 feet up the bank or shore to indicate a line perpendicular to the water's edge. Each pair of stakes or sector may be numbered if you wish. There should be a sector for each exploring party. (See food web drawing.)

### Teaching Outline

Introduction and briefing (10 minutes)

1. Assemble the explorers at the base camp (a fairly smooth area near the area to be explored).
2. Divide the group into teams of 3 children.
3. Have each party choose its surveyor, biologist, and recorder.
4. Describe the activity to them by reviewing the following procedures.

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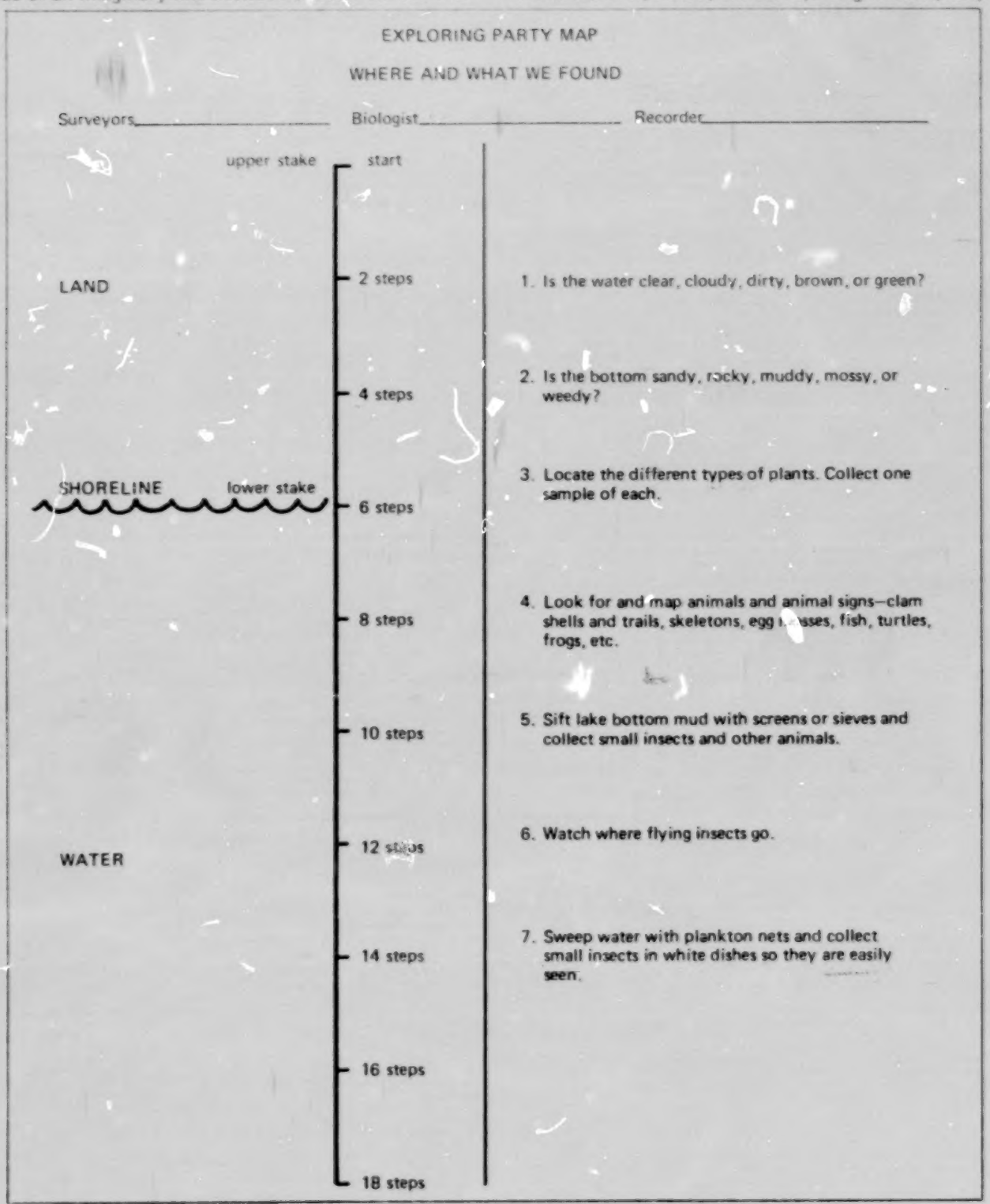
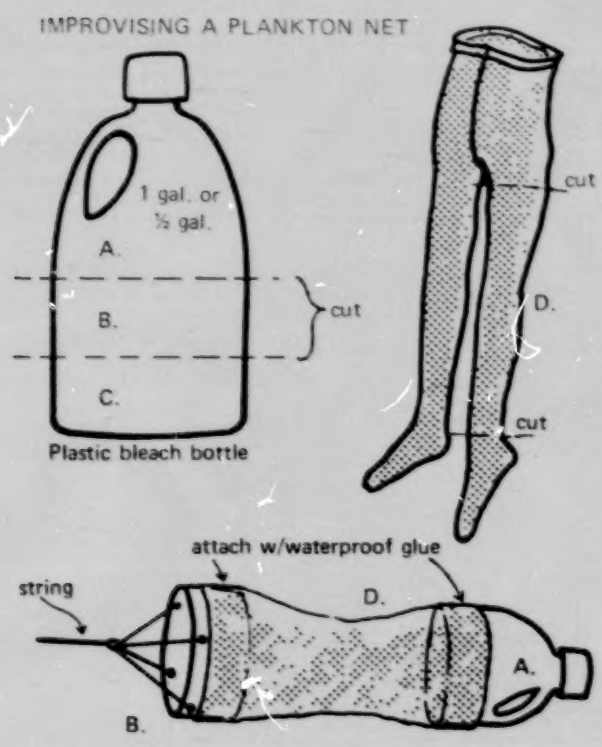
Exploring the shore (5 minutes)

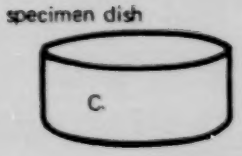
Each party should begin its exploring at the upper stake. The children should note animals and signs of animals within about an arm's length of either side of an imaginary line between the two stakes. The surveyor can keep track of the location by counting the steps walked from the upper stake. (An average step would be between 2 and 2½ feet.) The biologist particularly should look for various types and signs of animals (shells, tracks, skeletons, living animals, drop-


EXPLORING PARTY MAP
WHERE AND WHAT WE FOUND
Surveyors
Biologist
Recorder
upper stake
start
LAND
2 steps
4 steps
SHORELINE
lower stake
6 steps
8 steps
10 steps
12 steps
WATER
14 steps
16 steps
18 steps
1. Is the water clear, cloudy, dirty, brown, or green?
2. Is the bottom sandy, rocky, muddy, mossy, or weedy?
3. Locate the different types of plants. Collect one sample of each.
4. Look for and map animals and animal signs—clam shells and trails, skeletons, egg masses, fish, turtles, frogs, etc.
5. Sift lake bottom mud with screens or sieves and collect small insects and other animals.
6. Watch where flying insects go.
7. Sweep water with plankton nets and collect small insects in white dishes so they are easily seen.

pings, etc.). The recorder may draw a line lengthwise on a sheet of paper using it for a map, marking it off into 9 fairly equal sections, each section representing 2 steps along the imaginary line between the stakes. Then the recorder marks the location of animal signs on this map. Suggest that the recorder draw pictures of the tracks that can't be identified.

IMPROVISING A PLANKTON NET




Directions:

1. Cut bottle as shown with scissors.
2. Cut pantyhose, keeping section D. If using hose, just cut off the foot.
3. Seal section D to section A as shown.
4. Insert B (middle section of the plastic bottle) into the top of the old hose and attach with waterproof glue.
5. Retain C for examining the captured plankton.

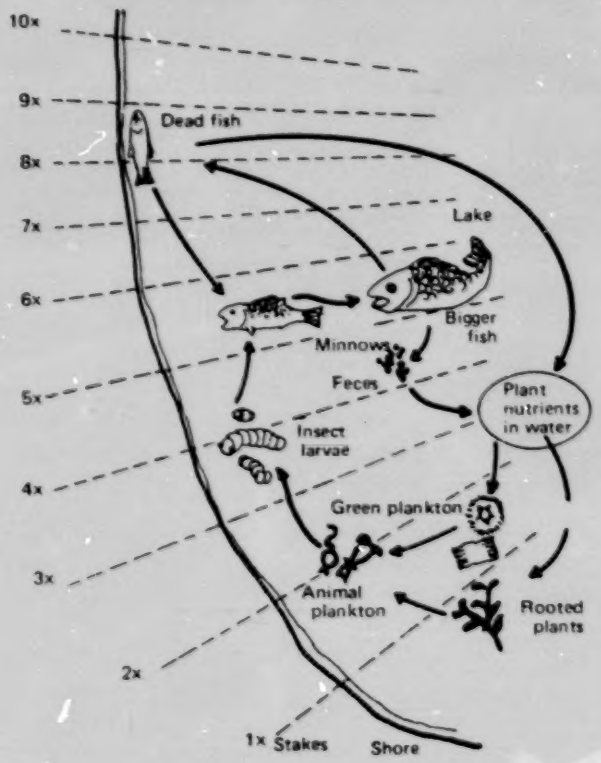
Exploring the water (15 minutes)

Each party can continue the exploration on a line projected from the stakes out into the water. They should go into the water as far as they can safely wade or as far as 30 feet from shore. The recorder can use additional sheets of paper to continue his map. As the explorers map the water area, they should describe the following:

1. color of the water—clear, cloudy, dirty, brown, green. How far down into the water can they see?
2. the lake bottom—clear sand, muddy, rocky, weedy, etc. Have them put small samples of the bottom sand or mud in a couple of plastic sandwich bags from 2 locations 10 and 20 feet from shore.
3. types of vegetation in the water—rooted plants, algae, etc. Have them collect one sample of each type of plant they find, roots and all. Plastic ice cream pails are good containers for their collections.
4. animals and animal signs in the water—clam trails, skeletons, shells, egg masses, fish, crayfish, turtles, frogs, etc. Take a sample where possible.
5. small animals in the bottom mud. Using kitchen strainers or 6-inch square pieces of window screen, parties can sift a little of the bottom to screen out any small animals found. These can be put in coffee cans, jars or other containers.
6. insects, either swimming or flying. Note where they rest or hide.
7. plankton in the water. Use a plankton net to sweep the water for very small and microscopic plants and animals. Have the parties collect the material from the nets in glass jars.

Reporting (15 minutes)

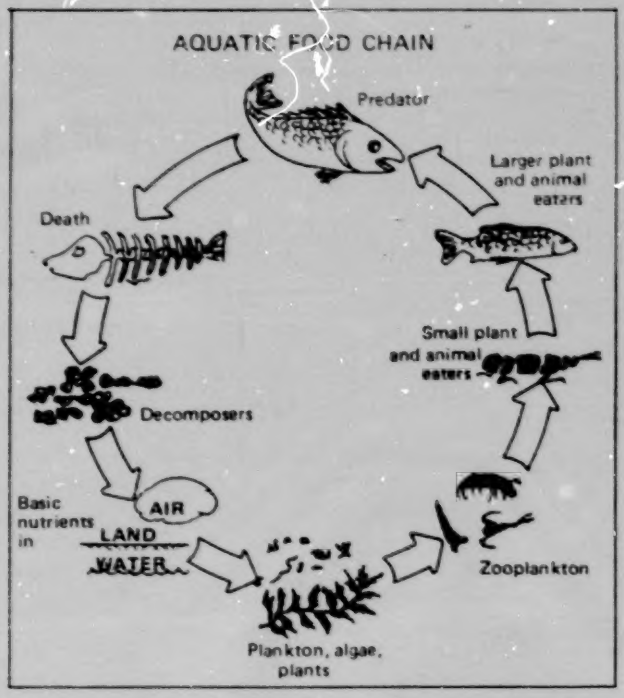
Reassemble the explorers at the base camp. Sketch a map of the entire area on the large sheet of paper. The map should show the various numbered sectors the parties have explored. Ask each recorder



to tell what animals and animal signs were found along the shore and to write these names or draw the animal tracks in the appropriate places on the map.

Now consider the water. Ask recorders to tell what kinds of animals were found and to mark the locations on the big map. They should write or draw in the kinds of vegetation they found in the water. Let them use very simple descriptive terms. Don't get very involved in scientific names. The children may identify the plants and animals by simply referring to the book POND LIFE.

The explorers may use hand magnifying lenses to look at their animal collections. Ask two or three recorders to draw pictures on the map or describe the small animals found in the lake bottom. Ask two or three other recorders to describe what they collected with their plankton nets. Note these on the map with simple descriptive words or drawings.




Getting it all together (15 minutes)

Ask for volunteers to draw a food web on the map connecting the various forms of life. Explain the food web.

Describe the concept of the food pyramid by asking the explorers leading questions.

**Helps for the Chief Explorer**

LIFE IN A POND, National Audubon Society, 1130 Fifth Avenue, New York, N.Y. 10028. 20 cents.

POND LIFE. (A Golden Nature Guide by Western Publishing Co., New York.) Available at book stands, about $1.25.

AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA
Environmental Education
Activity Sheet No. 8

# EXPLORING THE SOIL

Clifton Halsey, extension conservationist-soils and assistant professor, Department of Soil Science

Soil is necessary for most living things. Through their roots, plants get nutrients and water from the soil. Plant roots must use air in the soil; they also depend on soil for anchorage or support. Soil is home for many kinds of microscopic organisms and burrowing animals. Runoff water carries minerals from the land to nourish aquatic life forms in ponds, lakes, streams, and oceans. Soil provides the foundations, minerals, and construction materials for many of man's activities.

Soil quality varies from place to place. This variation affects its suitability for plants, animals, and man. This activity is an opportunity to study a few soil characteristics, which are keys to suitable land uses.

**Objective**

Each person should be able to identify four major components of the soil (minerals, organic matter, air, water), point out two or three obvious differences between two example soils, and give simple reasons for these differences.

**Specifications**

Age group: 10- to 12-year-old children.
Activity time: about 1 hour.
Group size: 10 to 30 children, divided into scouting parties of 3 to 6 in each party.
Chief explorer (group leader): a senior high school or college student: one for each 6 to 12 children.

Exploring the subsoil with an auger and yardstick

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Location: choose an even, gentle to moderate, south-facing slope about 100 feet long, if possible. Locate one study site about 25 feet from the top of the slope and the other near the bottom (not in standing water or very wet soil). Otherwise make the best use of available land.

**Equipment**

for each scouting party:

1. an exposed natural soil profile along a road, ditch or gully; or a pit dug about 3 feet deep,
2. a garden trowel or small shovel,
3. 2 sheets of paper, stiff writing board, and pencil,
4. 5 plastic sandwich bags,
5. a small plastic ice cream pail,
6. a hand magnifying lens bought at a variety store,
7. a soil auger for each 2 parties.

for the chief explorer:

1. 2 large sheets of paper fastened to a hard surface such as cardboard, about 2 x 2 feet,
2. a good shovel or spade for digging pits,
3. a black wax crayon or felt-tip pen,
4. a roll of cellophane tape,
5. a yardstick or sewing tape measure for each pit.

**Site Preparation**

If exposed profiles are unavailable, dig 2 or 3 pits about 3 feet deep at upper and lower sites. Make the south-facing side of the hole fairly smooth and vertical so that the children see the natural appearance of the soil. Place the soil neatly to one side so that the scouting parties may examine it. (Keep topsoil and subsoil separate.) If suitable sites are already available, dig a vertical side into the bank so moist soil is exposed down 3 feet from the top. Fasten the yardstick or tape measure to the side of each pit. (See drawing on back page.)

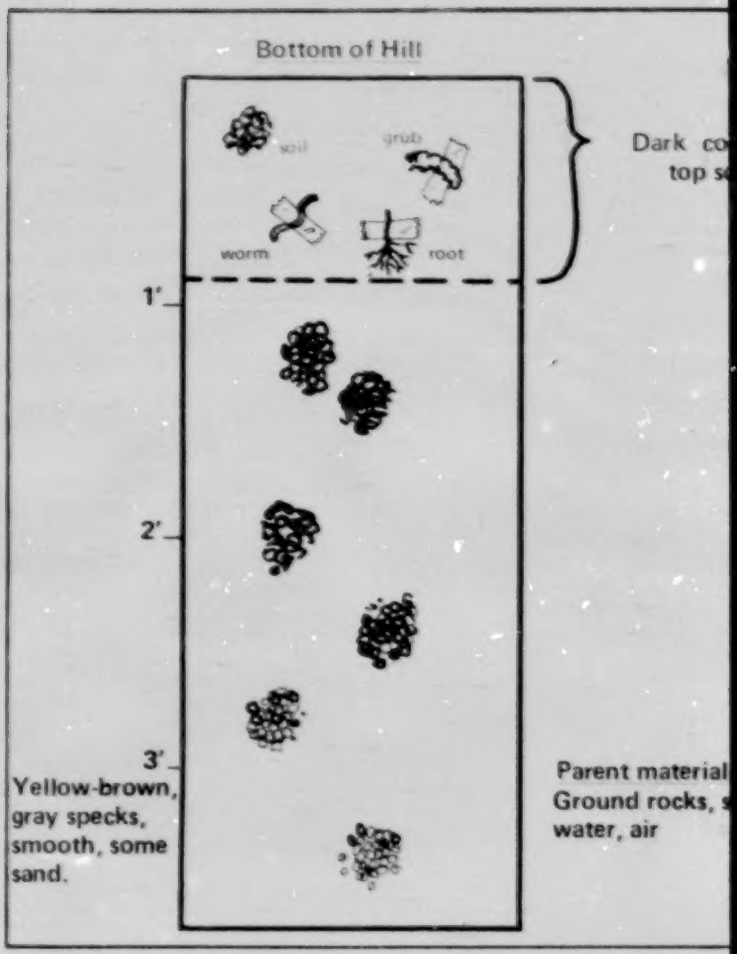
**Teaching Outline**

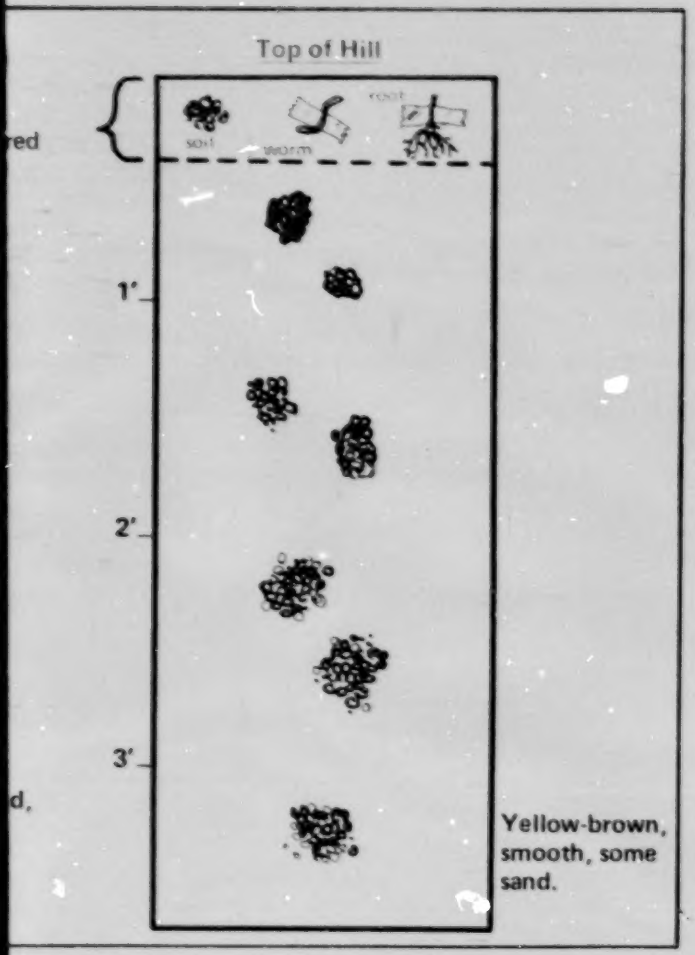
Exploring (25 minutes)

If possible, assemble the children in an area where all the soil scouting sites can be seen. Explain the activity.

1. Let's pretend that suddenly we are all about the size of a big grain of sand like this dot– . –(about 1/16 inch in diameter). We are able to crawl through the soil just as if we are small insects. We are now a group of foreigners lost in a strange place–the soil. It's very dark, cool, and damp.
2. We divide into scouting parties (3 to 6 in each party) to explore the area. The teams will explore the topsoil, the subsoil, and the parent material from which the soil is made. Give them their equipment.
3. The children should look at some of the soil they can take from the side of the pit or from the piles that have already been dug. They should also look at the sides of the holes to learn what they can about the surface. Some will be looking at soil near the top of the hill, other parties scouting soil at the bottom of the hill. We want to find out whether or not the soil is the same. If there are soil differences, we will find out what makes them.
4. As they explore, they should collect information about the history of the soil. They will drill with the auger, below the exposed side another foot or so to get at the parent material from which the soil is made. Because their pretend heights are only about 1/16 inch, the depth they are digging is equal to about 2,500 feet or the depth of some of the underground iron mines in northern Minnesota. They should drill only about 3 inches at a time to avoid getting the auger stuck in the hole.
5. Go to your exploring sites now. Work as scouting parties. Try to identify as many different parts of the soil as you can. What is the soil made of? One member of each party should be the recorder and write down what is found. Bring back a sample of each item. Label each sample as to the depth it was found. We'll fasten some of the items to a soils map we'll make.

(Move around from party to party, make sure they understand what their mission is and answer their questions.)






Reporting and mapping (25 minutes)

After 15 to 20 minutes, reassemble the scouting parties.

1. Have them tell what they found.
2. Using their information, make two soil profile map drawings.
3. Have the drawings side by side on the same sheet of paper. You may wish to follow the identification system on the attached sketch.
4. Have the groups consider these points.

First, let's talk about the surface soil.

What color is the surface soil? black, gray, brown, yellow?

Ask them to place some of the soil on the maps in the proper places.

What does the surface soil feel like (texture)? sandy, gritty, smooth, sticky.

How big are the smallest particles of soil?

What else did you find in the surface soil? (little spiders, earthworms, insect cocoons, plant roots, pieces of leaves and stems, moisture, air spaces, worm tunnels, pebbles or rocks, etc.)

Have them tape some of the items to the map—worm, pebble, root, etc.

What makes the surface soil darker than the parent material? (organic matter, decayed plants and animals)

Why is there room in the soil for water? (it fills the air spaces)

Is air needed in the soil? What happens when the spaces are all filled with water and there is no air in the soil? (the explorers would drown and die; so would the soil animals and most of the plant roots)

Ask the children if there were any differences—comparing topsoil at the top and the bottom of the hill. If they are not sure, go back and look at the edges of the holes. Have them compare the soils from both locations.

Now let's look at the subsoil and parent material.

What color is it? brown, yellowish brown, reddish brown, gray, speckled with gray or yellow?

Let the parties put some soil on the lower portions of the maps to show the color of the material. Invite the other children to feel and compare the parent material from below their topsoil with their own topsoil. Ask them to tell how the samples differ. What is the parent material made of? (ground up rocks and minerals, water and air)

How does the soil feel? (coarse—meaning sandy—, smooth, sticky, sticky sand, etc.)

How did the parent material get to this location? Have the children give answers and discuss them. Keep them imagining they are as small as a big grain of sand. They should be using their hand magnifying lenses to view the material they are supposedly exploring.

Is there air in the parent material? How about water? How does the water get there?

Are there any plants (roots) or animals in the parent material?

Ask the children which soil they could live in easiest if they really were mini-people. Relate this thought to plants.

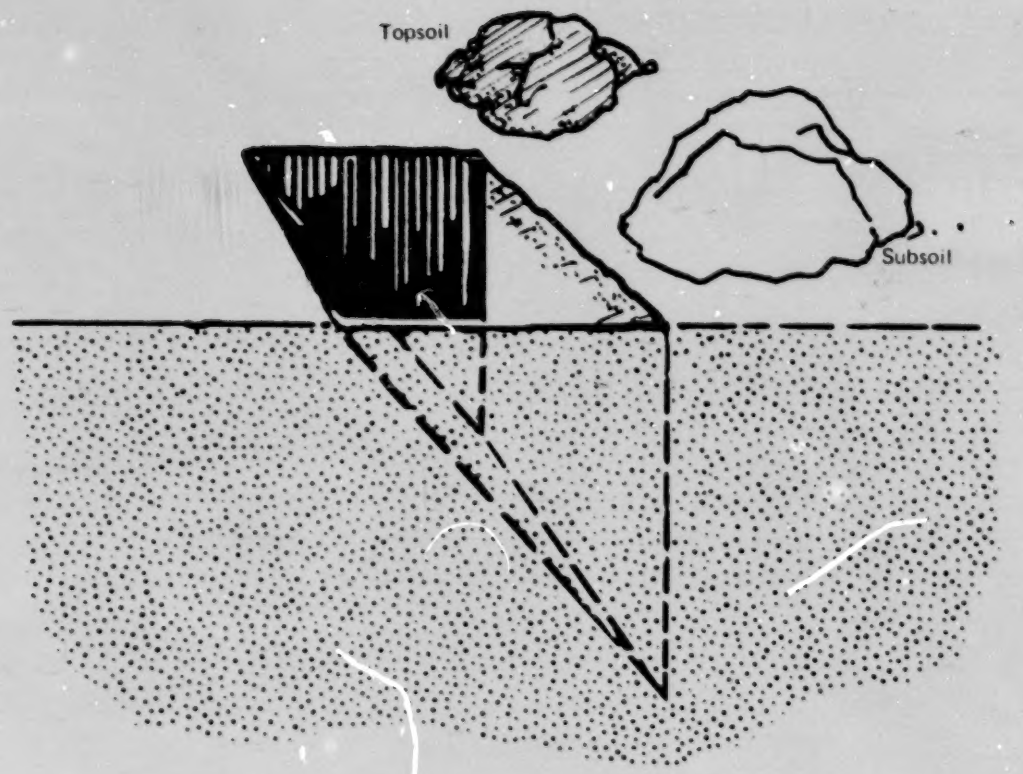
Reviewing what we've discovered (5 minutes)

Soil is made up of mineral matter that comes mostly from the parent material, usually left by enormous glaciers in most of Minnesota. There are air spaces between the mineral particles. Much of the air space may be filled with water. Most topsoil also has some organic matter in it. This has formed from the decay of plants and animals during many years. A good topsoil for growing plants will be about half mineral and organic matter (mostly mineral matter) and about half spaces, half of them filled with water.

Soil formation is a very slow natural process. The factors affecting the formation of soil are the parent material, the steepness and length of the slope, the native vegetation on the land, the climate, and the length of time these factors have been working.

References

MINNESOTA NATURAL RESOURCES TEACHING GUIDE, University of Minnesota Agricultural Extension Service Special Report 30(a).


Topsoil
Subsoil

AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA

Environmental Education
Activity Sheet No. 9

# Exploring Gray Squirrel Environments

Clifton Halsey
Extension Conservationist–Soils

Gray squirrels can thrive in wooded residential and recreation areas as well as in their natural environment. Many people enjoy watching and feeding squirrels. Learning the habits and needs of squirrels is also fun. Learning about gray squirrels can also reveal clues to the needs of other animals and helps us understand how to manage wildlife.

### Objective

The objective is to recognize signs of gray squirrels living in the area, tell whether an area is good or poor squirrel habitat, and tell generally what is needed to improve the area for squirrels.

### Basic Concepts

An animal can live and prosper only in an environment that provides enough food, water, shelter, and living space throughout the year. The amounts of these requirements indicate the number of animals (population, carrying capacity) an area can support. Man can manage or influence animals and their environments to affect their health and increase or decrease their populations.

### Specifications

Age group: 6 years and older
Activity time: about 1 hour
Group size: 3 to 15 people exploring in parties of 2 to 3 in each party.
Group leader: a person somewhat older than the group—high school or college student, teacher, or adult leader
Site: a wooded area ranging in size from a small neighborhood (2 to 3 city lots) to several acres (a city block). Some large deciduous (not evergreen) trees are desirable.

### Equipment

1. Suitable site.
2. "Explorers' Guide" (on page three of this sheet) for each group.
3. Pencil for each group.

### Advance Preparation

1. Study this Activity Sheet.
2. Select a wooded area 2 to 3 lots or larger in size that has at least some of the requirements for squirrels.
3. Evaluate the area yourself using the "Explorers' Guide."

### Teaching Outline

Introduction and explanation (15 minutes)

1. In your own words and with leading questions, discuss some of the more interesting habits and life requirements of gray squirrels. Ask people in the group to tell what they know or have experienced with gray squirrels.
2. Divide the group into exploring parties of 2 to 3 people.
3. Give each party a copy of the "Explorers' Guide" and review it with them.
4. Assign each party to a separate "territory" of about 1 acre (approximately 200x200 feet) or the size of 2 to 3 city lots.

Exploring the territory (20 minutes)

Ask the parties to explore their territories for about 20 minutes. They can use copies of the "Explorers' Guide" as a guide and record.

Sharing discoveries (25 minutes)

Assemble the group. Ask each party to tell (a) what they found according to the "Explorers'

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Guide," (b) what they decided about the suitability of the area for squirrels, and (c) what is needed to make it better.

Have each party lead and show the group one or two of their most interesting discoveries.

Conclusion

Discuss with the group how other animals, including man and domestic animals, need food, shelter, and safety from enemies in order to live.

**Gray Squirrels, Their Habitat and Living Requirements**

Gray squirrels are common in Minnesota. They are easily distinguished from their smaller cousins, the noisy red squirrels, and their larger ones, the reddish brown fox squirrels. Gray squirrels are 16 to 23 inches long, including 8 to 9 inches of bushy tail. Most of their fur is salt and pepper gray; the belly is whitish.

Habitat and habits

Gray squirrels prefer the larger hardwood (deciduous) trees. They like farm woodlands near other larger wooded areas, small tracts of hardwoods surrounded by open farmlands, and wooded areas along streams. Gray squirrels have adapted to human environments, especially in residential areas and parks having large trees. Squirrels can live without open water.

Gray squirrels range over areas of 1/5 to 7 acres (10,000 square feet to a city block). Squirrels, like many other animals, have a "territory," but it overlaps those of other squirrels. They prefer to travel from treetop to treetop rather than on the ground. Squirrels are most active during the morning and early evening. They doze during midday. Three to 4 young are born in March, weaned in June, and leave home in September. They may live from 6 to 10 years.

A gray squirrel eats about 2 pounds of food per week. Populations vary with the supply of foods including nuts, berries, and buds. During poor food years, squirrels may move considerable distances searching for better living conditions.

They prefer nuts and seeds of oak (acorns), basswood, beech, butternuts, elm, ironwood, maple, pine, walnuts, among others. Squirrels also eat the buds of many trees, especially in the spring. During the fall, they bury large quantities of nuts and pine seeds or store them in hollow trees and in buildings. During the summer and fall, squirrels eat fruits such as apples, blackberries, blueberries, dogwood, grapes, cherries, and tomatoes. They also eat insects, bird eggs, mushrooms, farm grains, and bird feed.

Shelter

Squirrels live in tree hollows or build leaf nests. Den trees are better; they provide year-round protection. Tree cavities 2 to 3 feet deep and having small entrance holes (2 to 3½ inches in diameter) are preferred. Other dens that are too large or too small, are damp, or have large entrance holes are used for escaping enemies. Dens having entrances at least 20 feet above ground are preferred.

Enemies and competitors for food and shelter

Many animals prey on squirrels. Among these are foxes, weasels, mink, dogs, cats, owls, hawks, and humans.

Those eating the same foods as squirrels are deer, mice, racoons, chipmunks, birds, wood ducks, wild turkeys, and humans.

Wood ducks, screech owls, chipmunks, raccoons, and porcupines use the same nesting dens.

Benefits and harmful effects of squirrels

Squirrels lose many of the tree seeds they bury in the ground. Many of the remaining seeds germinate and grow to become trees. Squirrels dig holes in lawns, eat corn and fruits, and damage some trees. They also nest in vacant spaces in buildings.

Maintaining and improving squirrel habitat

Save good, live, den trees from cutting; leave 2 to 3 scattered dens per acre (15 to 20 per city block). Good dens will be at least 20 feet above the ground and 2 to 3 feet deep below the entrance. The entrance hole should be 2 to 3½ inches in diameter. The tree trunk should be at least 15 inches in diameter. Save trees that are already being used by squirrels. If there aren't enough good den trees, provide artificial wooden dens or nesting boxes. Build these using the same dimensions as those for good dens.

Save and/or plant trees that provide good food for squirrels. Put out additional food for squirrels during the winter, especially during winters when nuts and seeds are scarce.

Control predators, especially house cats.

**References**

LEARNING TO LIVE, pages 12-14. Minnesota Department of Natural Resources, Bureau of Information and Education, Centennial Bldg., St. Paul 55155.

OAKS, ACORNS, CLIMATE, AND SQUIRRELS, National Wildlife Federation, 1412 Sixteenth St., N.W., Washington, D.C. 20036.

SQUIRRELS OF NORTH AMERICA, Dorcas MacClintock. Van Nostrand Reinhold Co., N.Y. 1970.

WILDLIFE HABITAT IMPROVEMENT, National Audubon Society, N.Y.

WILDLIFE, PEOPLE AND LAND, Department of Natural Resources, Madison, WI 53701.

Explorers' Guide

Note: Do not move anything that is a clue.

GRAY SQUIRREL

Do squirrels live here now?

Check the signs of squirrels you see in your area.

_____ squirrels

_____ squirrel tracks (maybe)

_____ large leafy nests (big as a basketball) in trees

_____ den holes (20 feet or more above ground)

_____ bare area around bottom of tree (no leaves)

_____ animal trail or tracks leading to tree

_____ piles or collections of nutshells and seed hulls or wings, corn cobs

_____ small holes dug in ground (2-finger size)

Is there plenty of food for all seasons?

Check the kinds of food or food trees in sight from your area.

_____ oak (acorns) or other nut trees (walnuts, beech, butternut, hickory, etc.)

_____ winged seeds (pine, maple, box elder, elm, ironwood, basswood)

_____ fruits (apples, crab apples, berries, grapes, cherries, tomatoes)

_____ farm grains (corn, oats, etc.)

Is there plenty of shelter for homes and nests?

check the ones you find.

_____ dens (hollows 2 to 3 feet deep in tree trunks, 20 feet or more above ground, entrance 2 to 3½ inches in size, trunk 15 inches or larger in diameter)

_____ large leafy nests high in trees

Are there enemies or signs of enemies in the area?

Check what you find.

_____ cats or dogs, their tracks or droppings

_____ owls or hawks, their roosts, droppings, or owl pellets (balls of bones, fur, and feathers)

_____ foxes, weasels, mink, or their tracks or droppings

_____ heavy automobile traffic

Are there good hiding places and safe above-ground travel lanes?

Check the ones you find.

_____ hollow trees

_____ treetops touching one another

_____ telephone cables

Is this a good or poor area for squirrels?

_____ Good _____ Poor

What else is needed to make it a good area?

_____ nothing _____ shelter

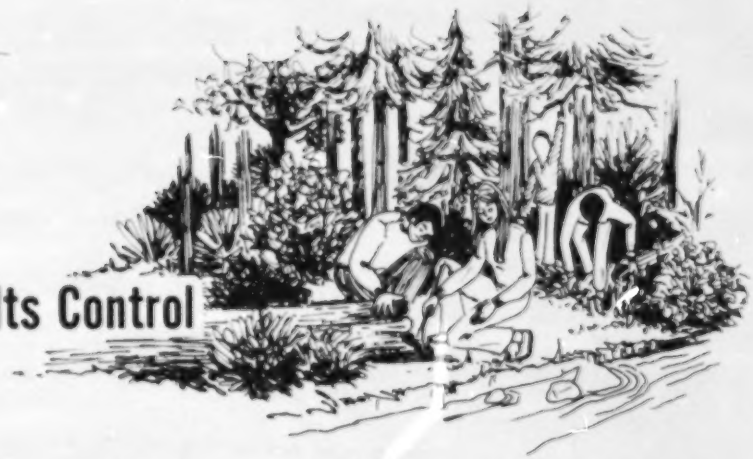
_____ food _____ control enemies

**Squirrel Tracks**

lower: hind feet upper: front feet

AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA

Environmental Education
Activity Sheet No. 10



# Studying Soil Erosion and Its Control

Clifton Halsey
Extension Conservationist–Soils

Soils vary widely from place to place. Not all soils are suitable for every purpose. Correct uses of soils help minimize their undesirable features and maximize their desirable qualities.

When weather conditions are suitable, the best place to study soils is outdoors under natural conditions. However, some soil situations can be simulated indoors. This sheet provides instructions for making soil management study boxes. It also outlines activities for using these boxes in studies and demonstrations, either indoors or outdoors.

## Objective

The objective is to discern differences in amounts of runoff, infiltration, and erosion as they are influenced by raindrop splash, steepness, protective cover, and direction of tillage.

## Basic Concepts

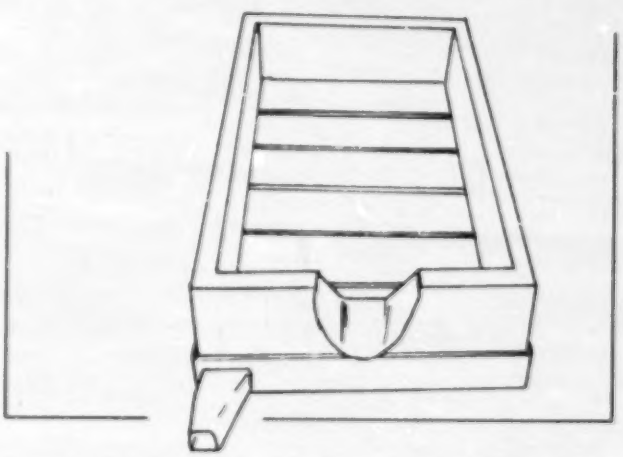
The earth's surface is continually changing. Soil erosion is a natural geologic process of relocation by means of gravity, wind, and water. The rate of erosion is influenced by soil texture, steepness, vegetative cover, and other characteristics. Man changes and manages soils to better satisfy his desires. He alters soils' character by tilling, changing the vegetation, and reshaping the surface. These changes may accelerate erosion. Eroded soil and excessive runoff produce harmful effects. Erosion and runoff may be controlled by tillage practices, vegetative cover, and sediment traps.

## Specifications

Age range: 9 years and older.
Activity time: about 1 hour.
Group size: 1-30 people.
Site: classroom or outdoors where an accidental spill of water is not harmful.

## Equipment

1. Soil management study boxes (two are needed for one activity).
   a. Construct a sturdy, reasonably watertight box about 12 inches wide, 24 inches long, and 4 inches deep. (See drawing.)
   b. Attach a notched metal overflow spout on one end as illustrated.
   c. Cut slits about 4 inches apart across the bottom of the box to permit drainage of percolating water.
   d. Improve internal drainage by lining the inside bottom of the box with a sheet of "hardware cloth" (wire mesh) wrapped in two layers of coarse cloth.
   e. Metal trays may be made to catch water dripping through the box. These trays may be fitted with spouts.
   f. Two boxes and drip trays are needed for tillage comparisons.
2. About ½ cubic foot (4 gallons) of slightly moist loam soil for each box.
3. From 5 to 10 gallons of water.
4. Twelve 1-quart, clear glass mason jars for collection and easy observations.



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5. Two sprinkling cans or rainmakers made from coffee cans or plastic pails. Sprinklers should deliver 1 quart of water in about 40 to 60 seconds. Fifteen holes about 1/16 inch in diameter are sufficient.
6. Small blocks 1, 2, 3, and 4 inches high to elevate one end of each box.
7. Coffee can full of clipped leaves or grass (loosely packed).
8. A work table or other surface not adversely affected by water.

### 1. Comparing Flowing Water, Raindrop Splash, and Vegetative Mulch as They Affect Soil Erosion and Runoff on Various Slopes.

**Preparation**

1. Fill one box with slightly moist loam soil. Crush the lumps and level the soil. Pack it firmly but not tightly. Pay special attention to the edges and corners.
2. Saturate the soil in the level box by slowly pouring 1 quart of water at intervals onto a small piece of paper on the surface. Repeat until water drips through the bottom of the box. The paper prevents the water from eroding a hole into the soil. This treatment will prevent the soil from absorbing extra water during the study.
3. Use the blocks to slant the box at 2 or more different elevations to observe the effect of slope.

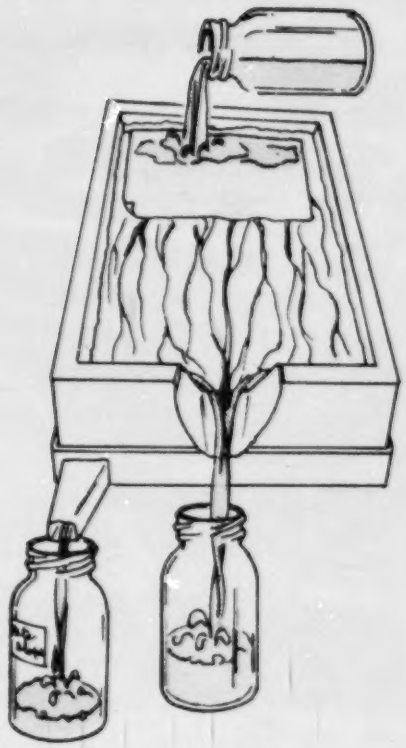
| | |
|---|---|
| Level | 0% slope |
| 1 inch elevation at upper end equals about | 4% slope |
| 2 inches | 8% slope |
| 3 inches | 12% slope |
| 4 inches | 17% slope |

4. Place the boxes so that the spouts project beyond the edge of the table.
5. Place quart containers below the spouts on chairs or boxes to collect the runoff and filtrate (water that percolates through the soil).

**Procedures and observations**

Effects of flowing water (runoff) without raindrop splash

1. Adjust the box to a 4 percent slope.
2. Slowly pour a quart of water over paper along the upper edge of the slope. Be sure the collecting jars catch all the runoff and filtrate. This procedure is comparable to runoff of snowmelt without the effects of splashing raindrops. It is similar to flood irrigation.
3. After most of the water has soaked through, label the jars as runoff or filtrate and record the percent slope.
4. Increase the slope to 8 percent, replace the collecting jars, and repeat steps 2 and 3.
5. Do the same for 12 and 17 percent slopes.
6. Compare the amounts of water running off and percolating through and the amount of sediment for each slope.
7. Save the water collections to compare them with the "effects of raindrop splash."



Showing the effects of running water without raindrop splash

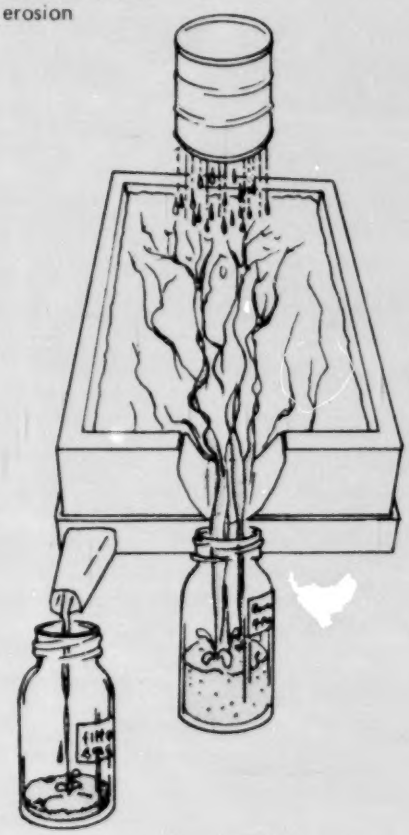
Effects of raindrop splash

1. Begin with a 4 percent slope and the same wet soil and follow the procedures above for the several slopes.
2. Use the sprinkler to "rain" a quart of water over the entire surface. Sprinkle the water evenly and sprinkle around the box quite rapidly.
3. After most of the water has soaked through, label the collecting jars, change to the next elevation, replace the jars, and rain more water. The same may be be done for 12 and 17 percent slopes.
4. Observe the differences in the amounts of runoff, filtrate, and eroded soil for the various slopes. (As the soil is "rained upon," it may become more impervious. Why?) Compare these collections of water with those from "runoff without raindrop splash." Save them to compare with effects of mulch.

Effects of vegetation or mulch on raindrop splash

1. Completely cover the soil (evenly) with clipped leaves or grass.
2. Follow the same steps as described under "effects of raindrop splash" for all four slopes.
3. Compare the results of the vegetative mulch with those of the raindrop splash without the mulch.

Showing the effects of raindrop splash on erosion



## II. Comparing Contour and "Up and Down Hill" Tillage as They Affect Soil Erosion and Runoff

**Preparation**

1. Fill two boxes with slightly moist loam soil. Crush the lumps and level the soil. Pack it firmly but not tightly. Pay special attention to the edges and corners.
2. Use a garden trowel to form contour ridges (across the slope about 1 inch high and 4 inches apart) in one box.
3. Form similar ridges lengthwise (up and down hill) in the other box.
4. Firmly pack the surface of the soil, including the ridges and valleys. Be sure the edges and corners are firm.
5. With both boxes level, sprinkle water on the soils until they are saturated. Do not erode the ridges.
6. Use the blocks described in study 1 to achieve the various slopes.
7. Place 1-quart containers below the spouts to collect runoff and filtrate.

### Procedures and observations

1. Adjust the boxes for 4 percent slope.
2. Rain a quart of water through the sprinklers over each box simultaneously. Sprinkle the water evenly and sprinkle around the boxes rapidly.
3. After most of the water has soaked through, label the collecting jars, change to the next elevation, replace the jars, and rain again. Repeat the procedures for the other slopes.
4. Observe the effects of the two tillage directions on the amounts of runoff, filtrate, and eroded soil.

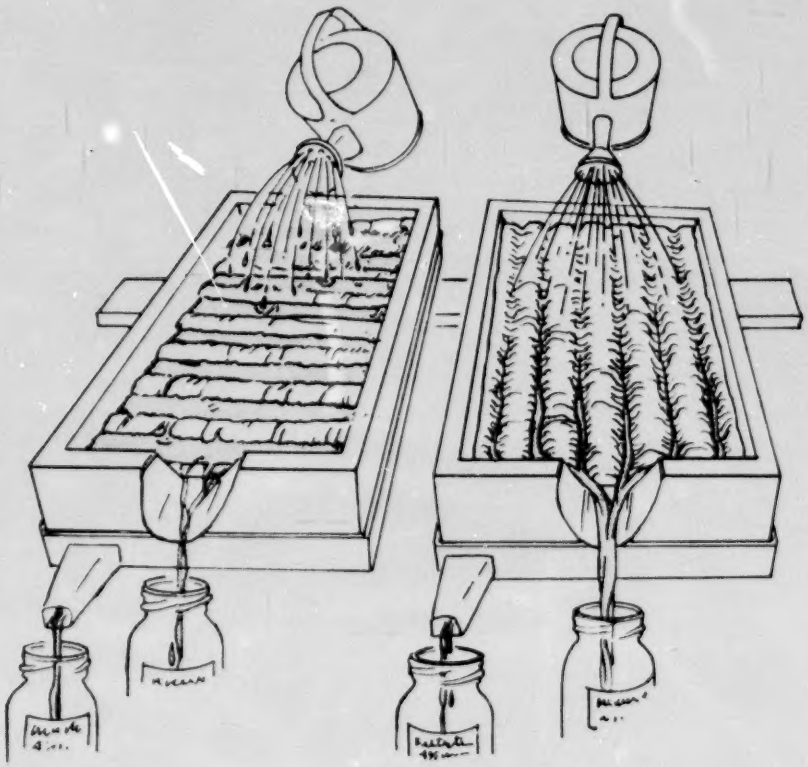
### Summary

Erosion is a natural geologic process, and its effects are largely beneficial. Vegetation is an important way to control erosion Agricultural practices, earthmoving operations, and other activities leaving soil unprotected by vegetation accelerate erosion on sloping land. Eroded soil carries plant nutrients with it to overfertilize lakes. The sediment also buries crops; fills in stream beds, reservoirs, and lakes; and does other harm. Tillage practices such as contouring, strip crops, mulches, and terraces can control agricultural erosion. Earthmoving contractors can control runoff and erosion during site preparation for roads and buildings. They can do this with mulches, vegetation, diversion terraces, and sedimentation ponds.

### References

Minnesota Natural Resources Teaching Guide, Special Report 30(a). University of Minnesota Agricultural Extension Service.

Teaching Soil and Water Conservation—A Classroom and Field Guide, PA-341. U.S. Department of Agriculture, Soil Conservation Service.



AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA
Environmental Education
Activity Sheet No. 11

# A Classroom Full of Trees

William R. Miles, Extension Forester
Roger R. Johnson, Jr., Elementary Education

In this exercise the children pretend to be trees and the teacher or leader, with some help from the children, is the forester. The exercise can be done in the classroom and should lead to an extensive discussion and other possible activities. You should "extend" this activity as far as it is useful for you.

**Objectives:**

1) To create an awareness of the dynamic differences between trees in the upland hardwood forest community and of how these differences affect forest management.
2) To illustrate why trees are removed from or left standing in the forest and the relationship of a tree's characteristics (age, vigor, form) to its use and value as a product or as a member of the forest community.
3) To show the interrelationships between members of the forest community and the changing environment within the community as members are removed through harvesting and added through reforestation.
4) To give students and the teacher a "comfortable" feeling in associating with the "trees" as living things in the classroom in hopes that this familiarity will be transferable to the outdoor classroom.

**Specifications:**

Upper elementary–lower secondary: age–10 years and older
Activity time: 1 hour
Group size: approximately 30

**Equipment:**

30 cards representing trees (see list). Children can prepare these. For example, look at the list, you will need cards for three black walnut trees: one 100-years old, one 60-years old, and one 30-years old. Trees are all healthy and well formed. The money value may be put on the card, or revealed later by the forester (teacher) during selection for cutting. Other aspects of value should appear on the card (i.e. shading a picnic area, home of woodducks, etc.). An example card from the chart might read:

> 100-year old sugar maple
> Struck by lightning (partially dead)
> Home for family of woodducks
> Value – $20.00

**Procedure:**

1) Each student will represent a tree.
2) Student will receive or make a card describing the type, age, health and form of tree. Student could wear the card.
3) Students should scatter around the room and attempt to "look like" their trees. For example, old or young (i.e. the 100-year old trees would be taller than the 70-year old trees), healthy or sick, straight or crooked.
4) The teacher (or later a student) will act as the forester. He will decide which trees to harvest based on the conditions a forester would consider in maintaining a forest:
   a) age (young, middle-age, old)
   b) health (disease, insects, animals, fire, lightning)
   c) form (straight or crooked)
   d) spacing (close together or far apart)
   e) value (product, recreation, wildlife, protection against erosion)
5) The teacher will begin to "cut down" trees for different reasons. These children will leave the forest. Explain to the "chopped-down trees" that they will be returned to the forest as "newly planted" trees.

   In this situation, which trees are taken? What makes sense to you? The students should be encouraged to participate in deciding which trees to harvest.
6) Suggested harvest:
   a) 100-year old black walnut.
   b) The 100-year old basswood not located at the headwaters of the stream. Why not both?
   c) The 30-year old basswood close to the walnut.
   d) The 100-year old sugar maples (two), except the one struck by lightning and with a woodduck family nesting, or would you take it too?

e) The 30-year old deformed maple.
f) The 100-year old oak trees
g) The 60-year old oak with oak wilt.

How many trees were harvested? What was their total value? Which trees are left? Why? What would you replant? (It would be helpful to have a side "2" on the cards explaining the next role. See Step 7.)

7) Suggested planting:

a) Five black walnuts in open areas.
b) One oak resprouted from an original stump. Return one student as sprout to original stump.
c) Three basswood trees resprouted from roots. Return three students near each stump.
d) One sugar maple was naturally seeded. Return one student near an older, healthy sugar maple tree.

All remaining "harvested trees" not replanted now become foresters to help with the next harvest. Now how many trees are there?

8) What do we harvest 40 years later? It would be helpful to have a side "2" on the cards with the information changed to reflect 40 years of growth. The new seedlings would now be 40 years old; the 60-year olds would be 100; the 30-year olds would be 70.

You're on your own now!

9) Things to Consider:

a) Are there still woodducks nesting?
b) Is a 140 year old ironwood safe as a shade tree?
c) Why not clearcut everything but black walnut and replant with black walnut?
d) What must you consider in harvesting?
e) Would it be better if all the trees were the same age?
f) How much money did you make on each harvest?
g) What would the lumber be worth in a lumber yard?
h) What use does the forest have besides growing wood? (Don't forget the nest, the picnic tables, etc.)

**Follow up:**

Adapt this exercise to an outdoor situation—the school grounds, a park, on a trip to a nature center—any place where there are trees. Have the children stand by "their" tree and assess ages, values, uses of each tree. Compare the reaction to "harvesting" in the indoor and outdoor classroom with the children.

**References:**

*Minnesota Forest Trees,* Extension Bulletin 363, Bulletin Room, Coffey Hall, University of Minnesota, St. Paul, MN 55108*

*Trees and Our Environment,* Extension Folder 253, same as above address*

*Forest Appreciation,* 4-H Bulletin 74, same as above address*

*Forest Management,* 4-H Bulletin 87, same as above address*

*Forestry for Minnesota Schools,* Minnesota Education Association, 41 Sherburne Avenue, St. Paul, MN 55103, $2.25.

*single copies free on request.

Make a card for each tree. This assumes a class of 30 students. If you have more or less students, make cards accordingly. You might add another kind of tree such as American elm.

| Kind of tree | Age | Value | Other information |
|---|---|---|---|
| Black Walnut | 100 | $1000 | Healthy |
| " | 60 | 100 | " |
| " | 30 | 10 | " |
| Basswood | 100 | $ 30 | Healthy |
| " | 100 | 30 | Protecting stream headwaters |
| " | 60 | 10 | Healthy |
| " | 60 | 10 | " |
| " | 60 | 10 | " |
| " | 30 | 1 | Crowding the 30-year old walnut |
| " | 30 | 1 | Healthy |
| Sugar Maple | 100 | $ 50 | Healthy |
| " | 100 | 50 | " |
| " | 100 | 20 | Lightning scar. Hole with woodduck nest. |
| " | 60 | 25 | Healthy |
| " | 60 | 25 | " |
| " | 30 | 5 | " |
| " | 30 | 5 | Broken top from ice storm. |
| Red Oak | 100 | $ 50 | Almost dead from oak wilt. |
| " | 100 | 50 | Healthy |
| " | 60 | 25 | Sick from oak wilt. |
| " | 60 | 25 | Healthy |
| " | 60 | 25 | Healthy, but very crooked. |
| " | 30 | 5 | Healthy |
| " | 30 | 5 | " |
| Ironwood | 100 | $ 0 | All are very small, healthy, |
| " | 100 | 0 | not bothering other trees, of |
| " | 100 | 0 | no value because of smallness |
| " | 60 | 0 | and very hard wood. |
| " | 60 | 0 | |
| " | 60 | 0 | |

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